



**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**  
**BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES**

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Bing  
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8/1/03

In re Application of )

Joel L. PASSKE, et al. )

Serial Number 09/887,523 )

Filed: June 21, 2001 )

For: FOOTWEAR WITH BLADDER FILTER )

Group Art Unit: 3728

Examiner: Stashick, A.

Attorney Reference: 005127.00094

**APPEAL BRIEF**

Commissioner for Patents  
U.S. Patent and Trademark Office  
Alexandria, VA 22313

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Sir:

Appellants hereby appeal to the Board of Patent Appeals and Interferences from the decision of the Primary Examiner finally rejecting claims 1-16 in the above-captioned patent application.

***(1) Real Party In Interest***

The real party in interest is Nike, Inc., a corporation organized and existing under the laws of the State of Oregon in the United States of America, and having its principal place of business at One Bowerman Drive, Beaverton, Oregon 97005.

***(2) Related Appeals and Interferences***

Appellants and the legal representative of the Appellants are unaware of any appeals or interferences related to the subject appeal.

### ***(3) Status of Claims***

Claims 1-16 (reproduced for reference in Appendix A) are pending in the application, with claims 1 and 9 being independent claims. The following claim rejections were made in the Office Action of February 26, 2003:

- (a) Claims 1-16 were rejected under 35 U.S.C. §103 as being unpatentable over a combination of U.S. Patent Number 5,845,417 to Reed et al. (hereafter referred to as Reed) and European Patent Application Number 1,074,193 to Opal Limited (hereafter referred to as Opal); and
- (b) Claims 1-14 and 16 were rejected under 35 U.S.C. §103 as being unpatentable over a combination of French Patent Application Number 2,670,369 to Colesnicenco Niculae (hereafter referred to as Colesnicenco) and Opal.

Each of the references cited in the rejections are included in Appendices B-D.

None of the pending claims have been allowed, and Appellants hereby appeal each rejection of the pending claims (i.e., claims 1-16).

### ***(4) Status of Amendments***

No amendments have been made to the claims subsequent to the Office Action of February 26, 2003.

### ***(5) Summary of Invention***

In various embodiments of the invention, an article of footwear includes a fluid system to either pressurize a cushioning bladder or ventilate the interior of an upper portion of the footwear. The fluid system incorporates a filter to prevent particulates and liquids, such as water, from entering the fluid system. As discussed in greater detail below, particulates and fluids that enter the fluid system may have a detrimental effect upon the operation of the fluid system.

With reference to the Figures provided in Appendix E, the article of footwear (Figures 1 and 2, element 100) includes an upper (Figures 1 and 2, element 110) and a sole structure (Figures 1 and 2, element 120). The sole structure further includes an insole (Figure 2, element 121), a midsole (Figure 2, element 122), and an outsole (Figure 2, element 123). In addition to the upper and the sole structure, the footwear includes a fluid system having a filter structure

(Figures 1-3, 5A, and 5B, element 130), first and second conduits (Figures 2 and 3, elements 140 and 170), first and second valves (Figures 2 and 3, elements 150 and 180), a pump (Figures 2 and 3, element 160), and a bladder (Figures 1-3, element 190).

The filter structure permits air to enter the first conduit, but restricts the entry of liquids and particulates. The first conduit, which may include the first valve, places the filter structure in fluid communication with the pump. The second conduit, which may include the second valve, places the pump in fluid communication with the bladder. Accordingly, air may pass through the filter structure and, through the action of the various components, the air may enter and pressurize the bladder (page 6, line 22 through page 7, line 5).

In operation, the pump is compressed by the weight of a wearer when the footwear is in contact with ground. As the footwear disengages from the ground, the pump returns to an uncompressed configuration, thereby drawing air through the filter structure and into the first conduit. The air then passes through the first valve and enters the pump. When the footwear again makes contact with the ground, the force of the wearer's body compresses the pump and increases the pressure of the air within the pump. Due to the increased pressure, air is forced into the second conduit, passes through the second valve, and enters the bladder. In this manner, the bladder receives ambient air through the filter structure and is pressurized (page 7, lines 6-23).

The filter structure prevents water, other liquids, and a variety of particulates from entering the fluid system and disrupting operation of the various fluid system components. If particulates were permitted to enter the fluid system, for example, the particulates could collect in the first valve and prevent the first valve from closing properly, thereby allowing air to freely return from the pump to the filter structure and escape to the atmosphere. In addition, water and particulates could collect in the bladder and become visible from the exterior of the footwear, thereby decreasing the aesthetic properties of the footwear. If water were permitted to enter the bladder or other portions of the fluid system, the weight of the footwear may be increased significantly. Furthermore, particulates may act as an abrasive that wears away portion of the system, thereby decreasing durability. Accordingly, the filter structure acts to prevent the entry of liquids and particulates that may have a detrimental effect upon the fluid system (page 8, line 15 through page 9, line 3).

The filter structure may have a variety of configurations. In general, however, the filter structure includes a filter (Figures 2, 3, 5A, and 5B, element 134), which provides a semi-porous

medium through which ambient air passes in order to enter the first conduit and, thereafter, the bladder (page 9, line 4 through page 10, line 7). Suitable materials for the filter include polytetrafluoroethylene (PTFE) or expanded polytetrafluoroethylene (ePTFE) that is disposed on a substrate material. PTFE and ePTFE exhibit the required characteristics and are suitably durable when attached to a substrate such as non-woven polyester. In addition, other suitable materials for the filter include high-density polyethylene, ultrahigh molecular weight polyethylene, polyvinylidene fluoride, polypropylene, and certain ceramic filter materials (page 12, line 19 through page 13, line 4).

The general concepts discussed above may be applied to fluid systems having different configurations. For example, an article of footwear (Figure 6, element 100a) may have a filter (Figure 6, element 134a) that is attached to an upper surface of a pump (Figure 6, element 160a) such that air from within an upper (Figure 6, element 110a) may pass through the filter and enter the pump. (page 17, line 14 through page 18, line 6) In addition, the concepts may be applied to a ventilation system. A filter (Figure 7, element 230) permits air to flow into a first conduit (Figure 7, element 240) and, thereafter, into a plurality of ventilation conduits (Figure 7, elements 290) that lead to the interior of an upper (Figure 7, element 210). A plurality of filters (Figure 7, elements 230') covers the ends of the ventilation conduits to prevent liquids and particulates from entering the fluid system. As with other configurations, the filters (elements 230 and 230') prevent liquids and particulates from entering the fluid system (page 18, lines 7-19).

In general, therefore, the invention relates to an article of footwear for receiving a foot of a wearer. The article of footwear includes an upper for covering at least a portion of the wearer's foot, a sole structure attached to the upper, and an air-filled bladder in fluid communication with ambient air and attached to the article of footwear. In addition, the footwear includes a filter in fluid communication with the bladder and the ambient air, the filter being structured to permit ambient air to enter the bladder and restrict liquids and particulates from entering the bladder. A variety of materials are suitable for the filter, and the filter may be a polytetrafluoroethylene filter.

**(6) Issues**

The following issues are presented to the Board of Patent Appeals and Interferences for consideration in this appeal:

- (a) Whether a proper motivation exists to combine Reed with Opal in the rejection of claims 1-16;
- (b) Whether a proper motivation exists to combine Colesnicenco with Opal in the rejection of claims 1-14 and 16;
- (c) Whether each element recited in claim 4 is disclosed in the references; and
- (d) Whether each element recited in claims 5 and 11 is disclosed in the references.

**(7) Grouping of Claims**

The following listing contains groups of claims that stand or fall together in the indicated groups:

- (a) Group 1 - Claims 1-3, 6-10,12-14, and 16;
- (b) Group 2 - Claim 4;
- (c) Group 3 - Claims 5 and 11; and
- (d) Group 4 - Claim 15.

Separate reasons are set forth below with respect to each group of claims.

**(8) Argument**

*First Issue - No Proper Motivation to Combine Reed and Opal*

Independent claim 1, and dependent claims 2-8, recite an article of footwear having an upper, a sole structure, a bladder, and “a filter in fluid communication with said bladder and ambient air, said filter being structured to permit ambient air to enter said bladder and restrict liquids and particulates from entering said bladder.” Additionally, independent claim 9 and dependent claims 10-16, recite a similar structure wherein the filter is a PTFE filter. The claims at issue recite, therefore, a filter that restricts liquids and particulates from entering the bladder.

To establish a *prima facie* case of obviousness, the burden is upon the Examiner to demonstrate reasons why a skilled artisan, confronted with the same problem as the inventor and with no knowledge of the claimed invention, would select the elements from the cited prior art references for combination in the manner claimed. *In re Rouffet*, 149 F.3d 1350, 1357, 47

U.S.P.Q.2d 1453, 1458 (Fed. Cir. 1998). Accordingly, obviousness cannot be established by combining the teachings of the prior art to produce the claimed invention, absent some teaching, suggestion, or incentive supporting the combination. *In re Geiger*, 815 F.2d 686, 688, 2 U.S.P.Q.2d 1276, 1278 (Fed. Cir. 1987). Furthermore, if the proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gordon* 733 F.2d 900, 902, 221 U.S.P.Q. 1125, 1127 (Fed. Cir. 1984). With regard to the present issue, the Examiner has not properly established the *prima facie* case of obviousness because no proper motivation exists to combine Reed with Opal, as detailed below.

Reed discloses multiple embodiments of a ventilated shoe having a fluid system that includes a filter in fluid communication with a pump. In general, the fluid system draws air and moisture from the interior of the upper and discharges the air and moisture to the exterior of the upper. Although specific information regarding the structure of the filter is not provided, Reed states that “[m]oisture and liquid, along with air, may be drawn through the filter 214 and into the pump cell” (Reed, column 8, lines 48-49). In addition, Reed states that “air is drawn through the filter and into the inlet of intake tube 258. The air and/or liquid then passes through intake valve 264 and through the monotube 260 into the pump cell 254” (Reed, column 10, lines 4-7). The filter disclosed in Reed expressly permits, therefore, the passage of liquids.

In discussing conventional insoles, Reed states “it is very difficult to remove moisture and the odor produced as a result of moisture which collects in the shoe due to foot sweating caused by poor shoe ventilation. Since most people use their shoes for long periods of time, it is essential to properly maintain and ventilate the shoes in order to avoid foot diseases, such as, for example, water-eczema” (Reed, column 1, lines 24-30). One would appreciate, therefore, that a beneficial attribute of the system disclosed in Reed is the capacity for liquids to pass through the filter, thereby removing the liquids from the area surrounding the foot.

Opal discloses an article of footwear having an upper with an arch portion. As stated in Opal, “[a] plurality of openings (24) are located in the arch portion (18). . . . A waterproof, breathable membrane (26) larger than the area of the openings (24) is secured to the upper part (16) across the openings” (Opal, column 3, lines 28-40). Furthermore, the “waterproof and breathable membrane is sandwiched between the inside and outside surfaces in the arch portion

of the upper part..." (Abstract). The membrane may be formed of a material such as Gore-Tex®, which includes polytetrafluoroethylene, otherwise referred to as PTFE.

Modifying the fluid system disclosed in Reed to incorporate the material disclosed in Opal would impermissibly render Reed unsatisfactory for its intended purpose. As discussed in detail above, the fluid system disclosed in Reed expressly permits liquids to pass through the filter, thereby removing the liquids from the area surrounding the foot. In order to accomplish the removal of liquids, "[m]oisture and liquid, along with air, may be drawn through the filter 214 and into the pump cell" (Reed, column 8, lines 48-49). The rejection of claims 1-16 states that "it would have been obvious, to one of ordinary skill in the art at the time the invention was made, to make the filter of Reed et al. '417 out of Gore-Tex®, as taught by Opal '193..." (Office Action dated February 26, 2003, page 2, lines 24-26). Utilizing the material disclosed in Opal, as proposed in the rejection, would effectively prevent the passage of liquids in the fluid system of Reed, thereby limiting the degree to which water may be removed from the area surrounding the foot. Combining Reed with Opal would, therefore, render Reed unsatisfactory for its intended purpose of removing liquids, such as water.

With reference to providing motivation, the Examiner asserted in page 4 of the Office Action dated February 26, 2003 that "Opal is designed to allow for the passage of water vapor through the material in which it is made, thereby allowing for the passage of liquid that has been heated by the foot to pass through the material as a vapor." The Examiner contends, therefore, that the Gore-Tex® material of Opal does permit the passage of liquid, in as far as the liquid is a vapor. Appellants respectfully submit, however, that liquid and vapor are two separate and distinct states of matter. One of ordinary skill would not be motivated, therefore, to modify Reed to include the Gore-Tex® material of Opal if an express attribute of the filter in Reed is to permit the passage of liquid. That is, one of ordinary skill in the art would not utilize a material that only permits the passage of vapor in an application that expressly involves a filter material that permits the passage of liquid, even if the liquid may be converted to vapor through heating by the foot.

For the reasons discussed above, modifying the fluid system disclosed in Reed to incorporate the material disclosed in Opal would render Reed unsatisfactory for its intended purpose of removing liquids. Accordingly, the Primary Examiner has not properly established

the *prima facie* case of obviousness because no proper motivation exists to combine Reed with Opal in the rejection of claims 1-16.

*Second Issue - No Proper Motivation To Combine Colesnicenco and Opal*

Colesnicenco discloses a fluid system that may be incorporated into an article of footwear for ventilating the interior of the footwear. A professionally prepared translation of Colesnicenco is enclosed with this Appeal Brief. Referring to page 3, lines 20-22 of the Colesnicenco translation, Colesnicenco teaches that the air filter consists of “a filtering material (1b) such as felt or another filtering material.” Felt is recognized as a cloth made of wool and fur often mixed with natural or synthetic fibers, or felt may be a firm woven cloth of wool or cotton heavily napped and shrunk. *Merriam-Webster’s Collegiate Dictionary*, Tenth Edition, 2000.

The recommendation that “felt or another filtering material” be utilized as the filter material in Colesnicenco does not teach or suggest the use of a filter that is structured to restrict the passage of liquids through the filter material. To overcome this deficiency, the rejection combines Colesnicenco with Opal. The mere fact that references can be combined or modified, however, does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination. *In re Mills*, 916 F.2d 680, 16 U.S.P.Q.2d 1430 (Fed. Cir. 1990). In this matter, the rejection presents no line of reasoning as to why a person skilled in the relevant art, when reviewing only the collective teachings of the references, would have found it obvious to selectively pick and choose various elements and/or concepts from the references to arrive at the claimed invention. In other words, the rejection does little more than cite Colesnicenco and Opal to show that one or more elements, when each is viewed in a vacuum, may be known.

As discussed with respect to the First Issue, the burden is upon the Examiner to demonstrate reasons why the skilled artisan, confronted with the same problem as the inventor and with no knowledge of the claimed invention, would select the elements from the cited prior art references for combination in the manner claimed. *In re Rouffet*, 149 F.3d 1350, 1357, 47 U.S.P.Q.2d 1453, 1458 (Fed. Cir. 1998). In this case, however, the Examiner has made no such showing, but instead has simply asserted that the combination may be made. This assertion, however, is not supported by the references. Whereas Colesnicenco teaches a fluid system for mechanically-ventilating footwear that incorporates conduits, pumps, and valves to forcefully

transfer air, Opal merely teaches the diffusion of air from the interior of the footwear to the exterior, and vice-versa, through the Gore-Tex® material. The fact that Gore-Tex may be utilized in footwear is not sufficient to suggest to one skilled in the art that the Gore-Tex material may be given a specialized purpose in a complex mechanical system that pumps air into the upper. Neither Colesnicenco nor Opal incorporate a teaching or suggestion that would motivate one skilled in the relevant art to make the combination suggested in the rejection.

The claims at issue recite a filter that restricts liquids and particulates from entering the bladder. Opal, however, merely teaches using Gore-Tex® in an upper of an article of footwear. More particularly, Opal teaches using Gore-Tex® as a portion of the upper to permit air transfer between the interior and the exterior of the footwear, while preventing liquid water from passing through the upper. Opal does not teach, therefore, Gore-Tex® material as a filter. Colesnicenco, however, teaches a mechanical ventilation system includes a filter material.

When determining the patentability of a claimed invention that combines two known elements, the question is whether there is something in the prior art as a whole to suggest the desirability, and thus the obviousness, of making the combination. *In re Rouffet*, 149 F.3d 1350, 1355, 47 U.S.P.Q.2d 1453, 1456 (Fed. Cir. 1998). With respect to the present matter, the rejection merely combines the material of Opal with the system disclosed Colesnicenco. More particularly, the rejection utilizes a material that is incorporated into an upper of an article of footwear in combination with a complex mechanical system for ventilating another article of footwear. The rejections do not, however, provide any reasoning as to how the prior art suggests the desirability of combining the references and has, therefore, failed to establish a *prima facie* case of obviousness.

For the reasons discussed above, there is no suggestion or motivation to make the proposed modification of Colesnicenco with the material disclosed in Opal. Accordingly, the Examiner has not properly established the *prima facie* case of obviousness in the rejection of claims 1-14 and 16.

#### *Third Issue - Elements Of Claim 4 Are Not Disclosed*

Claim 4 recites that the filter includes one of the group consisting of high-density polyethylene, ultrahigh molecular weight polyethylene, polyvinylidene fluoride, polypropylene, and ceramic filter materials. To establish a *prima facie* case of obviousness, the burden is upon

the Examiner to demonstrate that the prior art references teach or suggest all the claim limitations. That is, all of the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981 (C.C.P.A. 1974). Neither Reed, Colesnicenco, nor Opal disclose any of the filter materials recited in claim 4. Furthermore, the Office Action fails to even suggest that the materials recited in claim 4 are disclosed in the references. The rejections of claim 4 have, therefore, failed to establish a *prima facie* case of obviousness.

*Fourth Issue - Elements Of Claims 5 and 11 Are Not Disclosed*

Claims 5 and 11 recite that the filter is hydrophobic and oleophobic. The rejections, however, fail to address the limitations of claims 5 and 11. As stated above, to establish a *prima facie* case of obviousness of a claimed invention, all of the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981 (C.C.P.A. 1974). Neither Reed, Colesnicenco, nor Opal disclose hydrophobic and oleophobic properties of a filter. Furthermore, the Office Action fails to even suggest that the filter materials disclosed in the references may be hydrophobic and oleophobic. The rejections of claims 5 and 11 have, therefore, failed to establish a *prima facie* case of obviousness.

*Conclusion*

The rejections submitted in the Office Action of February 26, 2003 should be reversed for at least the reasons recited above. Allowance of claims 1-16 is, therefore, respectfully requested.


In accordance with 37 C.F.R. §1.192, Appellants submit this Appeal Brief in triplicate to the Board of Patent Appeals and Interferences. A Notice of Appeal was timely filed on May 23, 2003.

Filed concurrently herewith is a Fee Transmittal, a Request For Oral Hearing, and a Petition For Extension Of Time. The Fee Transmittal authorizes the Commissioner to charge a fee of:

- (a) \$320.00 for the filing of this Appeal Brief;
- (b) \$280.00 for the Request For Oral Hearing; and
- (c) \$110.00 for the Petition For Extension Of Time.

It is believed that no additional fees are due in connection with this Appeal Brief. Should additional fees be deemed necessary, however, such fees are hereby requested and the Commissioner is authorized to charge deposit account number 19-0733 for the payment of the requisite fee.

Respectfully submitted,

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Dated: July 25, 2003

**Appendix A**  
**Claims Involved in the Appeal**

1. An article of footwear for receiving a foot of a wearer, said article of footwear comprising:

- an upper for covering at least a portion of the wearer's foot;
- a sole structure attached to said upper;
- an air-filled bladder in fluid communication with ambient air and attached to said article of footwear; and
- a filter in fluid communication with said bladder and ambient air, said filter being structured to permit ambient air to enter said bladder and restrict liquids and particulates from entering said bladder.

2. The article of footwear of claim 1, wherein said filter includes polytetrafluoroethylene.

3. The article of footwear of claim 2, wherein said polytetrafluoroethylene is expanded polytetrafluoroethylene.

4. The article of footwear of claim 1, wherein said filter includes one of the group consisting of high density polyethylene, ultrahigh molecular weight polyethylene, polyvinylidene fluoride, polypropylene, and ceramic filter materials.

5. The article of footwear of claim 1, wherein said filter is hydrophobic and oleophobic.

6. The article of footwear of claim 1, wherein a perforated layer is located over said filter, said perforated layer permitting air to access said filter.

7. The article of footwear of claim 6, wherein said perforated layer prevents large particles and objects from contacting said filter.

8. The article of footwear of claim 1, wherein said bladder is located in said sole structure.

9. An article of footwear for receiving a foot of a wearer, said article of footwear comprising:

- an upper for covering at least a portion of the wearer's foot;
- a sole structure attached to said upper;
- an air-filled bladder in fluid communication with ambient air and attached to said article of footwear; and
- a polytetrafluoroethylene filter in fluid communication with said bladder and ambient air, said filter being structured to permit ambient air to enter said bladder and restrict liquids and particulates from entering said bladder.

10. The article of footwear of claim 9, wherein said polytetrafluoroethylene is expanded polytetrafluoroethylene.

11. The article of footwear of claim 9, wherein said filter is hydrophobic and oleophobic.

12. The article of footwear of claim 9, wherein a perforated layer is located over said filter, said perforated layer permitting air to access said filter.

13. The article of footwear of claim 12, wherein said perforated layer prevents large particles and objects from contacting said filter.

14. The article of footwear of claim 9, wherein said bladder is located in said sole structure.

15. The article of footwear of claim 14, wherein said filter is located in said sole structure.

16. The article of footwear of claim 14, wherein said filter is located in said upper.

**Appendix B**  
**U.S. Patent Number 5,845,417 to Reed et al.**



US005845417A

**United States Patent** [19]

Reed et al.

[11] **Patent Number:** **5,845,417**[45] **Date of Patent:** **Dec. 8, 1998**[54] **AIR COOLED SHOE HAVING AN AIR EXHAUST PUMP**[75] Inventors: **Rusty Allen Reed**, Grand Prairie, Tex.;  
**Mark D. Murrell**, 424 Halifax,  
Coppell, Tex. 75243[73] Assignees: **Rusty A. Reed**, Grand Prairie; **Mark D. Murrell**, Coppell, both of Tex.[21] Appl. No.: **517,877**[22] Filed: **Aug. 3, 1995****Related U.S. Application Data**

[63] Continuation-in-part of Ser. No. 325,678, Oct. 19, 1994, abandoned, and a continuation of Ser. No. 648,861, May 6, 1996, Pat. No. 5,697,170.

[51] **Int. Cl.<sup>6</sup>** ..... **A43B 7/06**[52] **U.S. Cl.** ..... **36/3 B; 36/3 R**[58] **Field of Search** ..... **36/29, 3 R, 3 A, 36/3 B**[56] **References Cited****U.S. PATENT DOCUMENTS**

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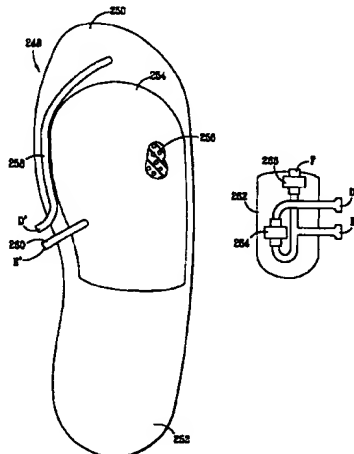
640720	12/1936	Germany .	
89045	4/1937	Sweden .....	36/3 R
2 193 080	2/1988	United Kingdom .	
2 240 254	7/1991	United Kingdom .	
2 262 024	6/1993	United Kingdom .	

*Primary Examiner*—B. Dayoan*Attorney, Agent, or Firm*—Mark W. Handley; Gregory M. Howison; Joe H. Shallenburger

## [57]

**ABSTRACT**

A ventilated shoe for ventilating the foot contains an outer sole (204). A heel pad (206) is disposed at the rear end of the outer sole (204). An intake tube (228) is disposed near the front of the outer sole (204). The intake tube (228) is connected to pump cell (210). An exhaust tube (234) is also connected to pump cell (210). An intake valve (242) is disposed along the intake tube (228) and an exhaust valve (244) is disposed along the exhaust tube (244). The intake valve (242) only allows air to flow through to the pump (210). The exhaust valve (244) only allows air to flow out of the pump cell (210). The pump cell (210) is filled with an open-celled foam (212) so that when no pressure is being applied to the pump cell (210), it draws air in through the intake tube (228). When pressure is applied to the pump cell (210), the open-celled foam (212) is compressed and the air is expelled through the exhaust tube (234).

**11 Claims, 10 Drawing Sheets**

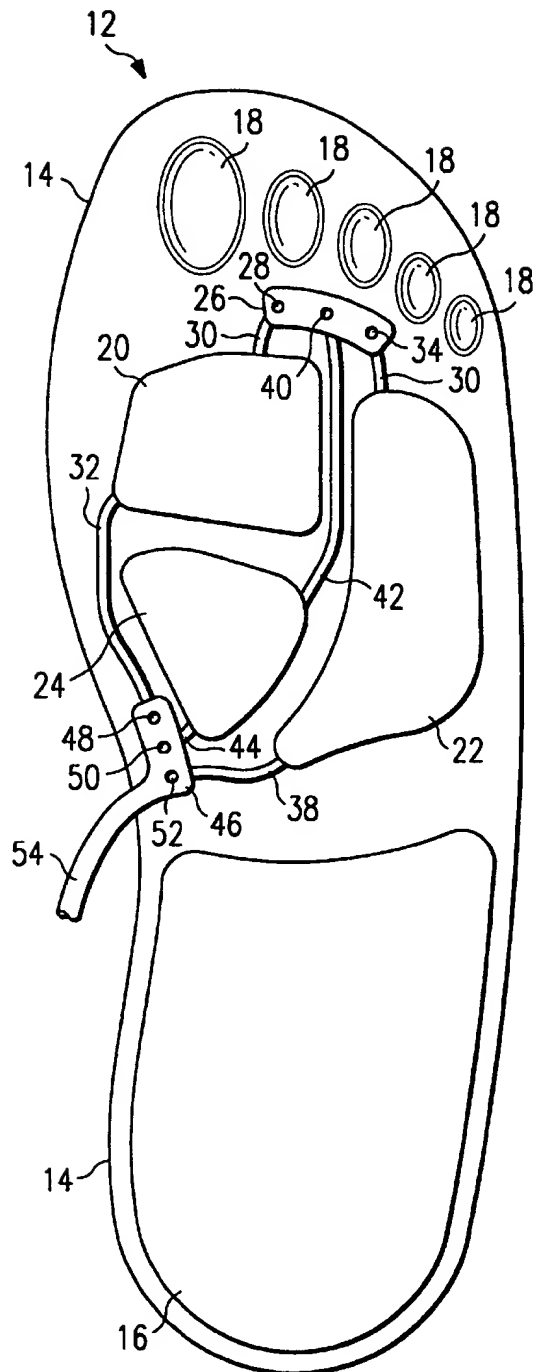


FIG. 1a

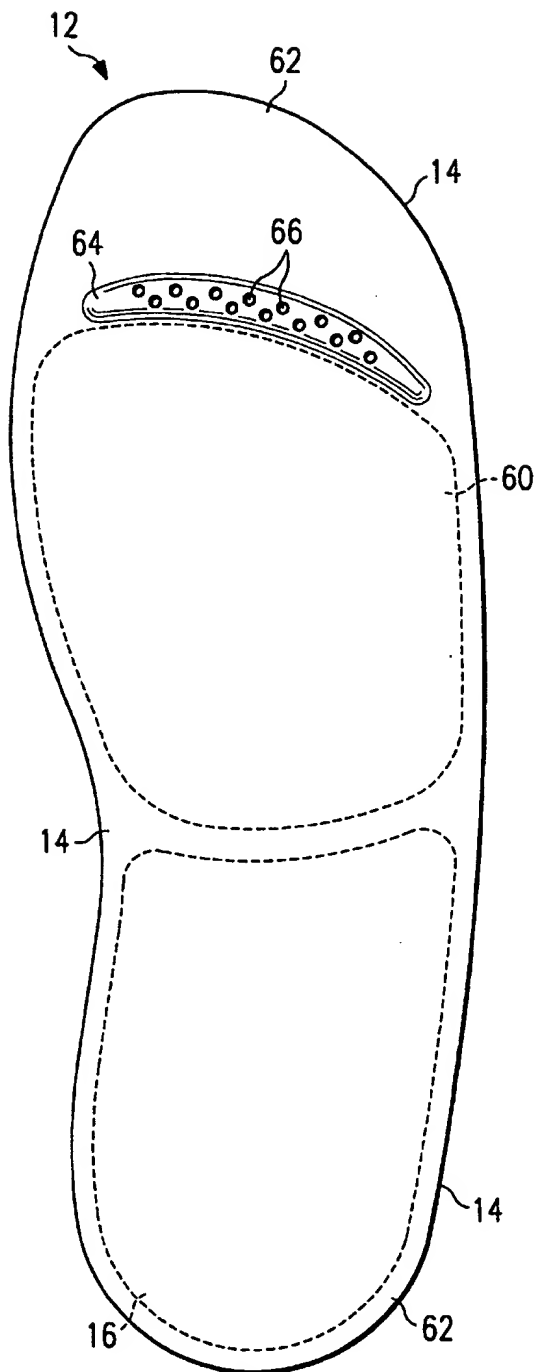


FIG. 1b

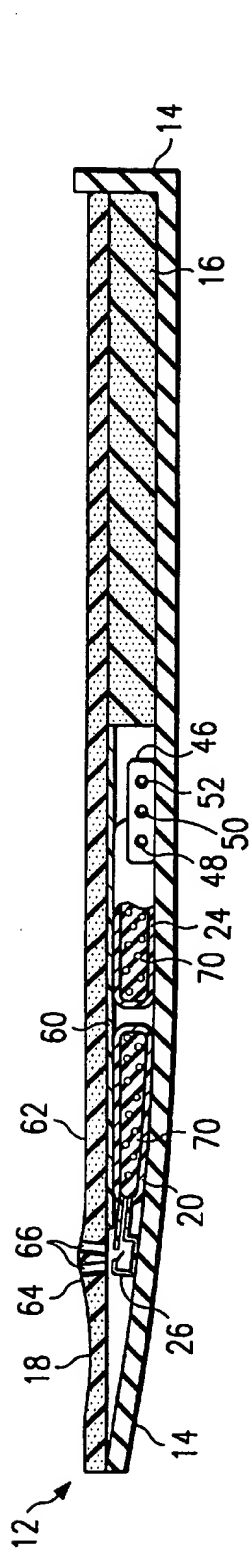


FIG. 1c

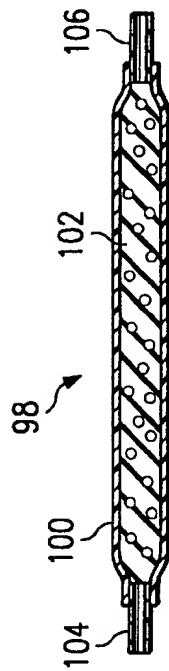


FIG. 2b

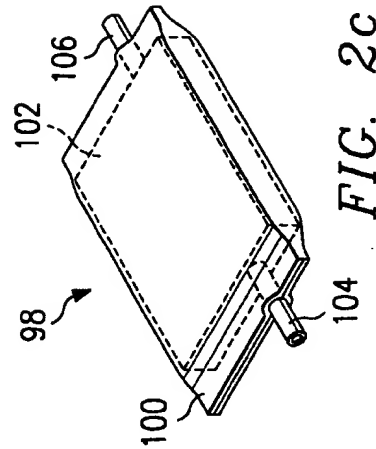


FIG. 2c

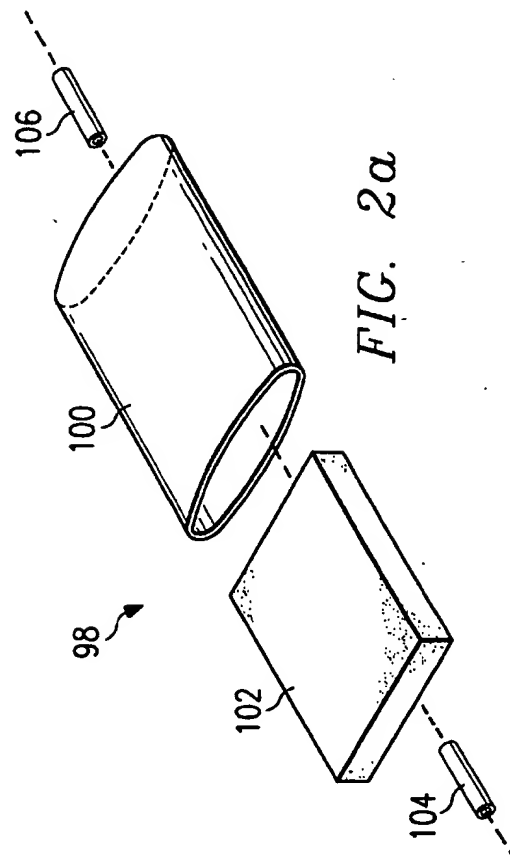
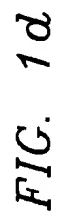
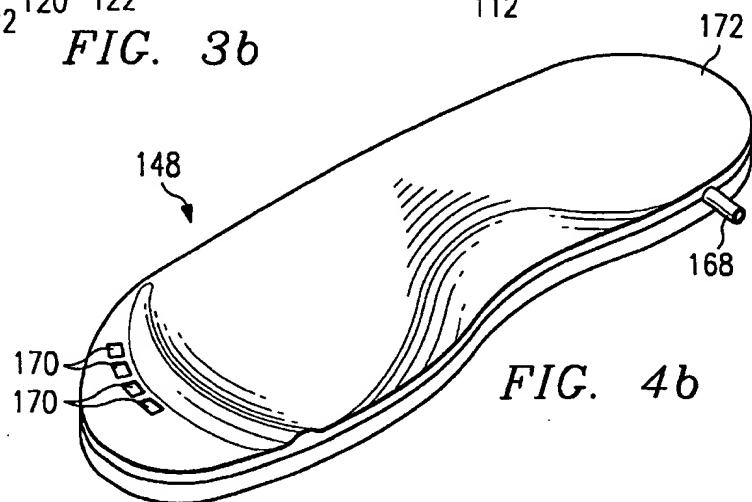
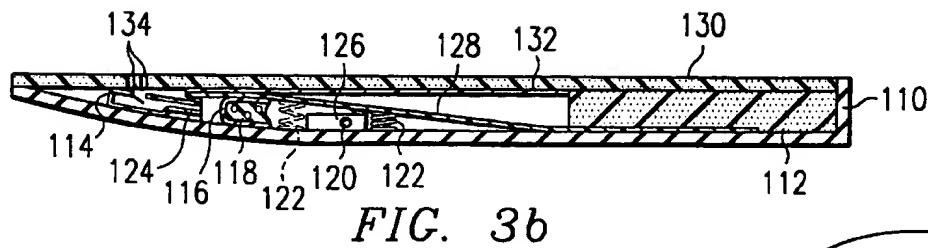
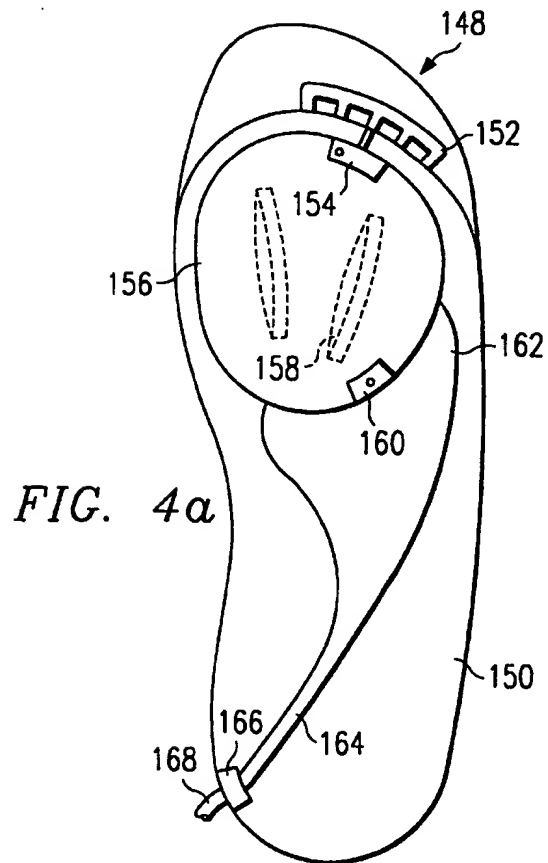
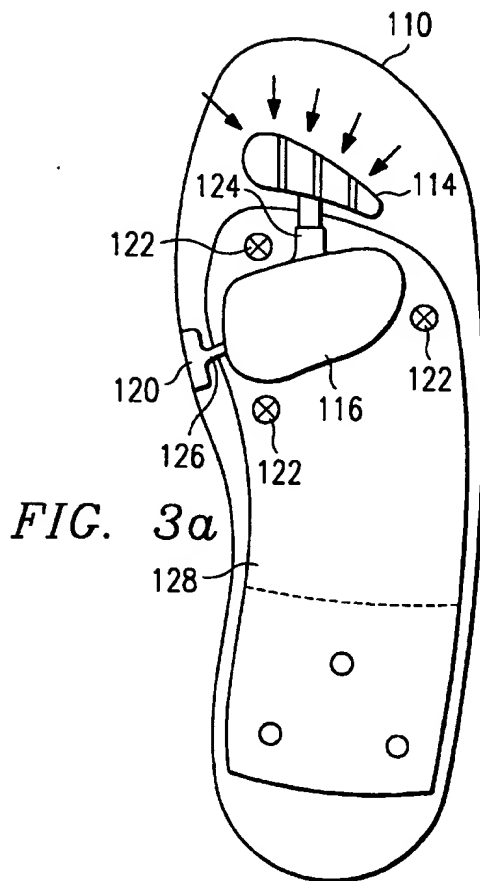
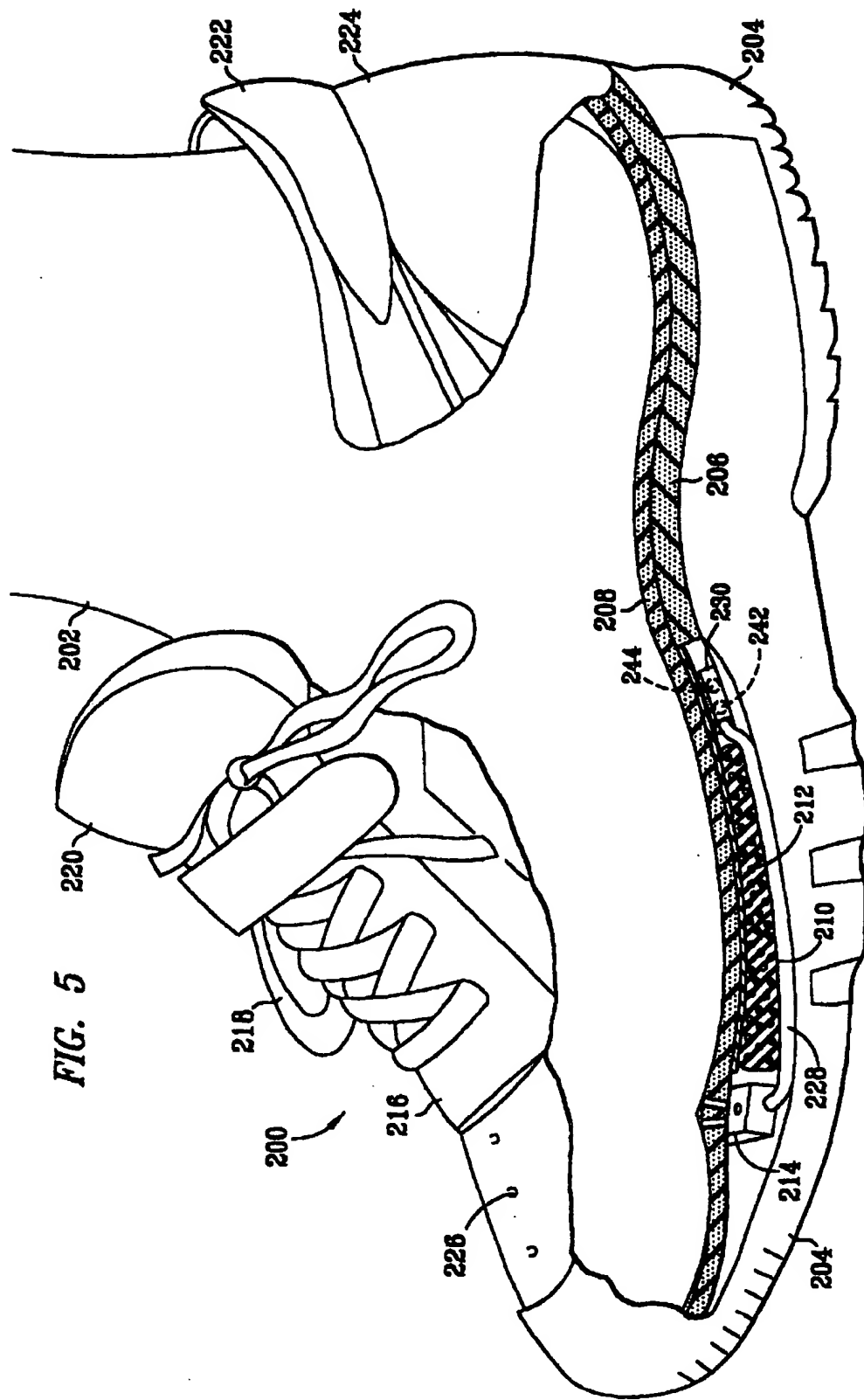
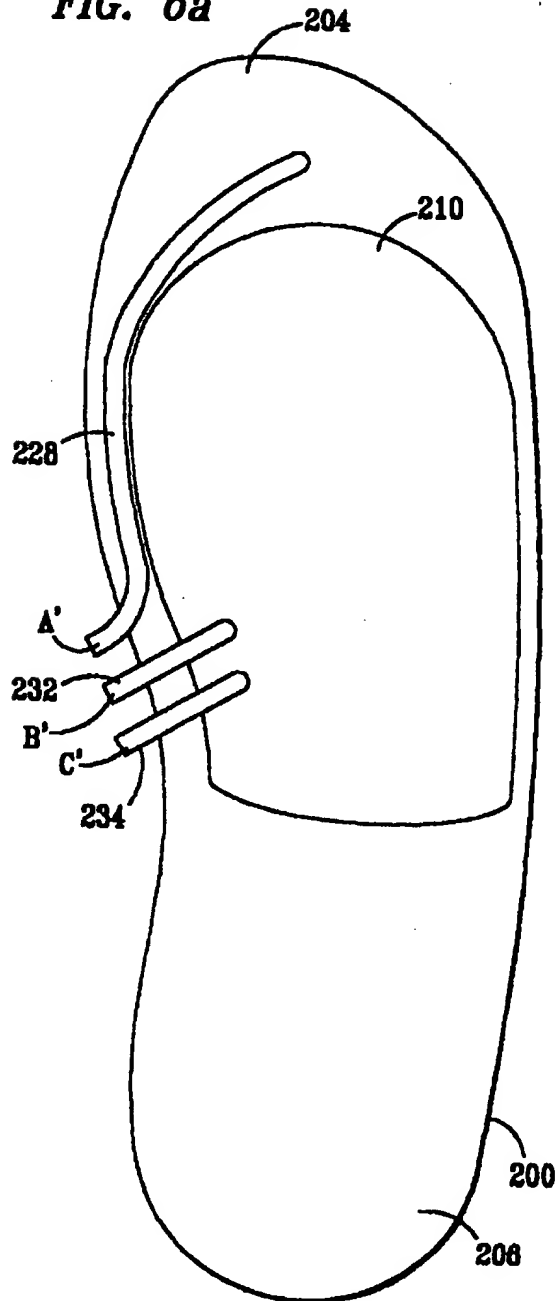
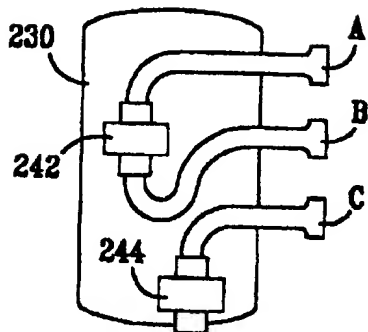
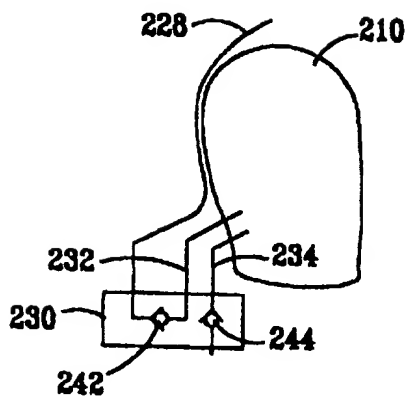


FIG. 2a

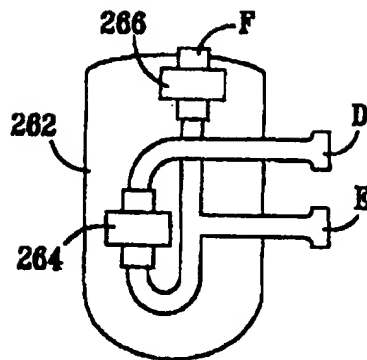




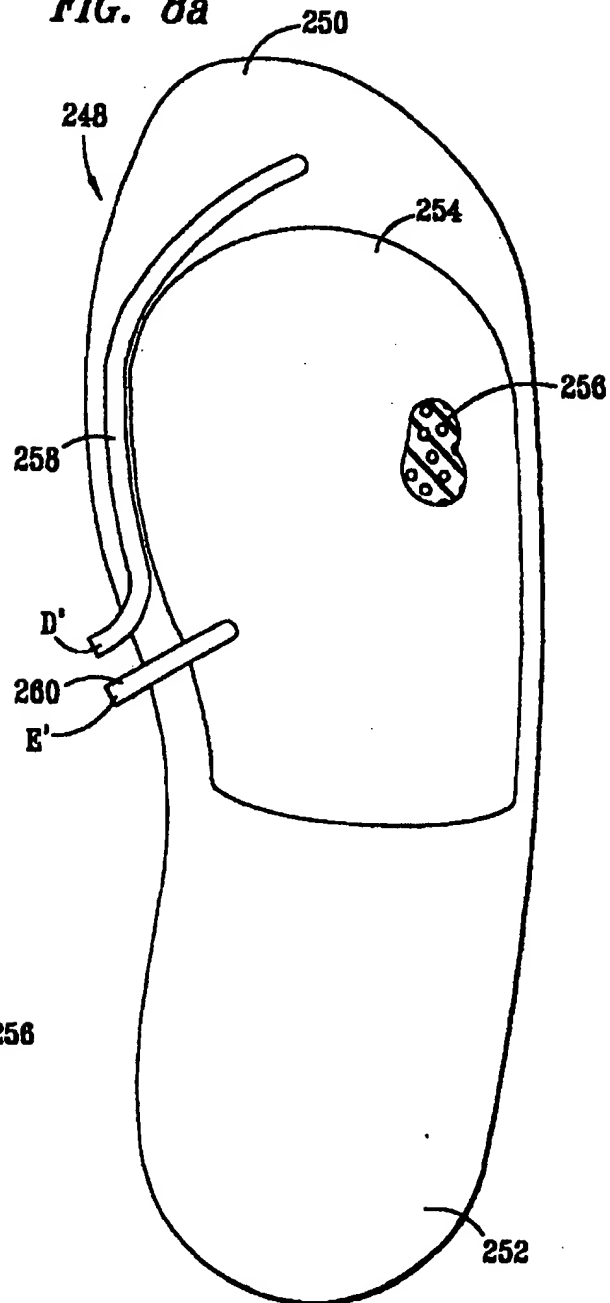


*FIG. 6a**FIG. 6b**FIG. 7*

**FIG. 8b**



**FIG. 8a**



**FIG. 9**

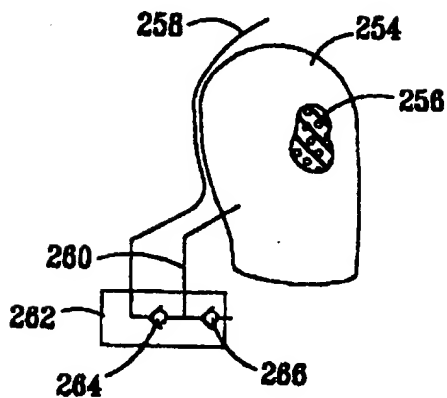


FIG. 10a

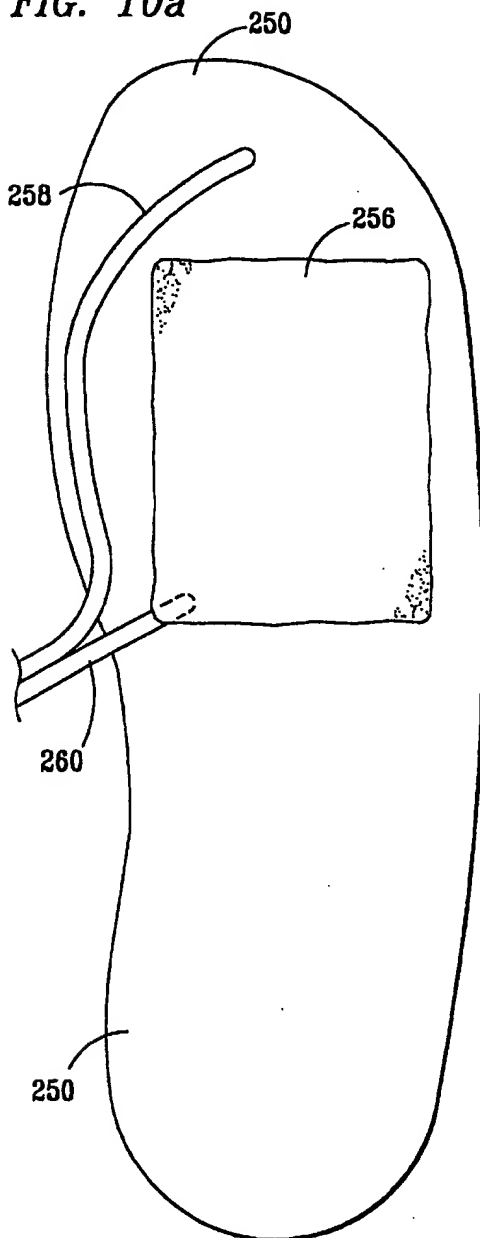


FIG. 10b

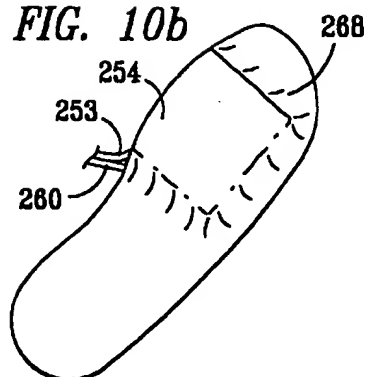


FIG. 10c

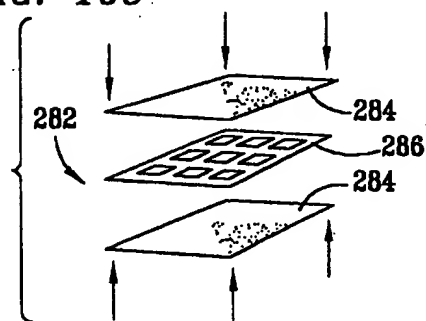


FIG. 10d

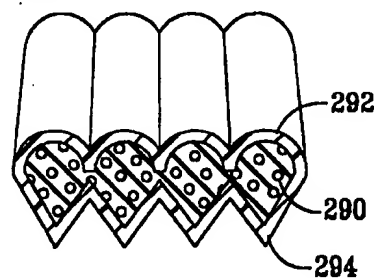
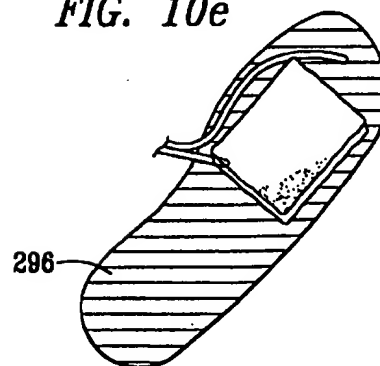
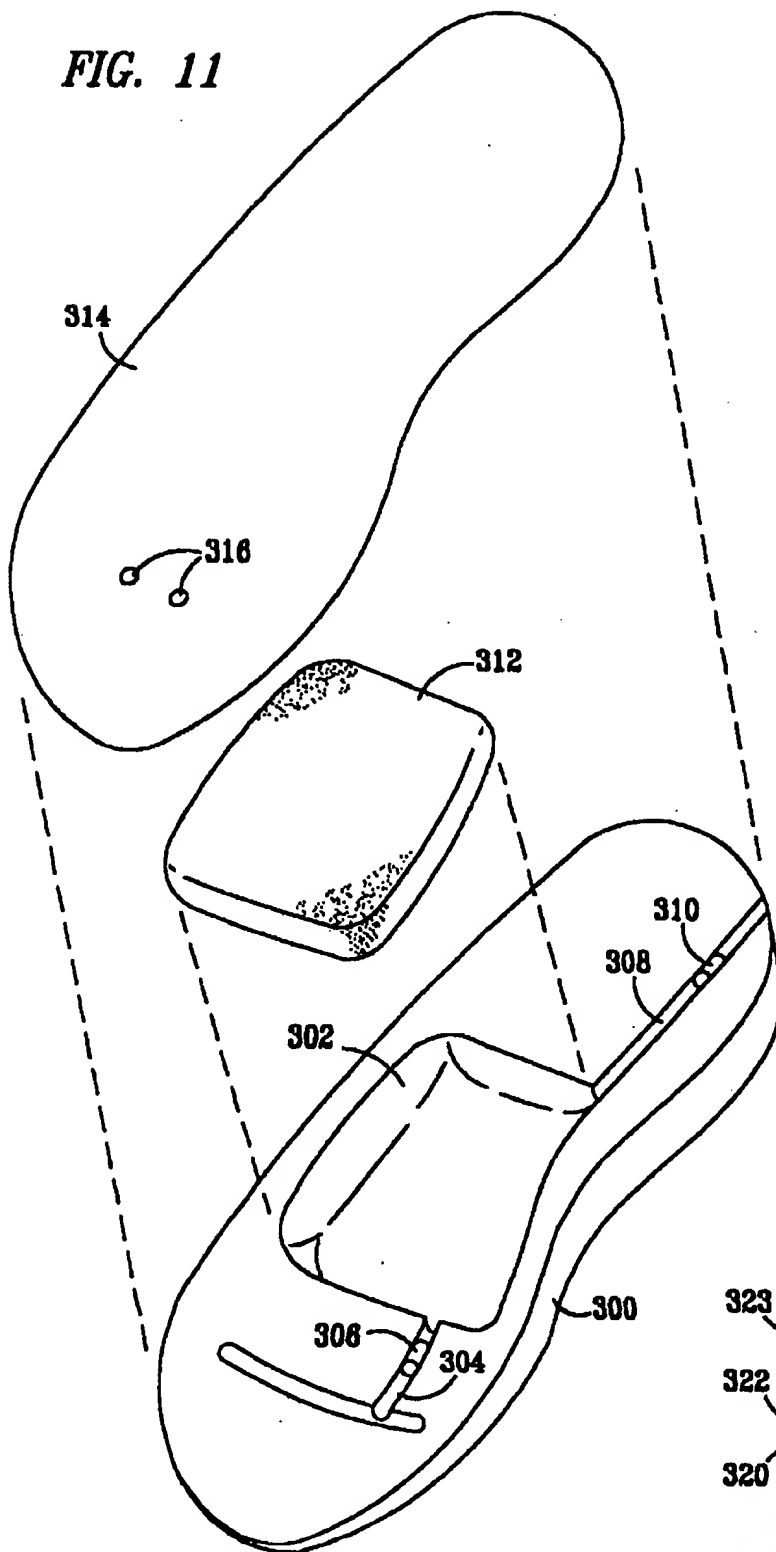
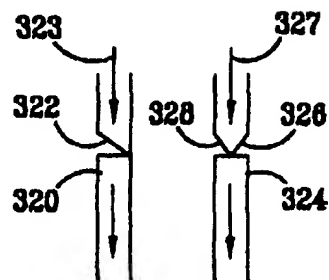
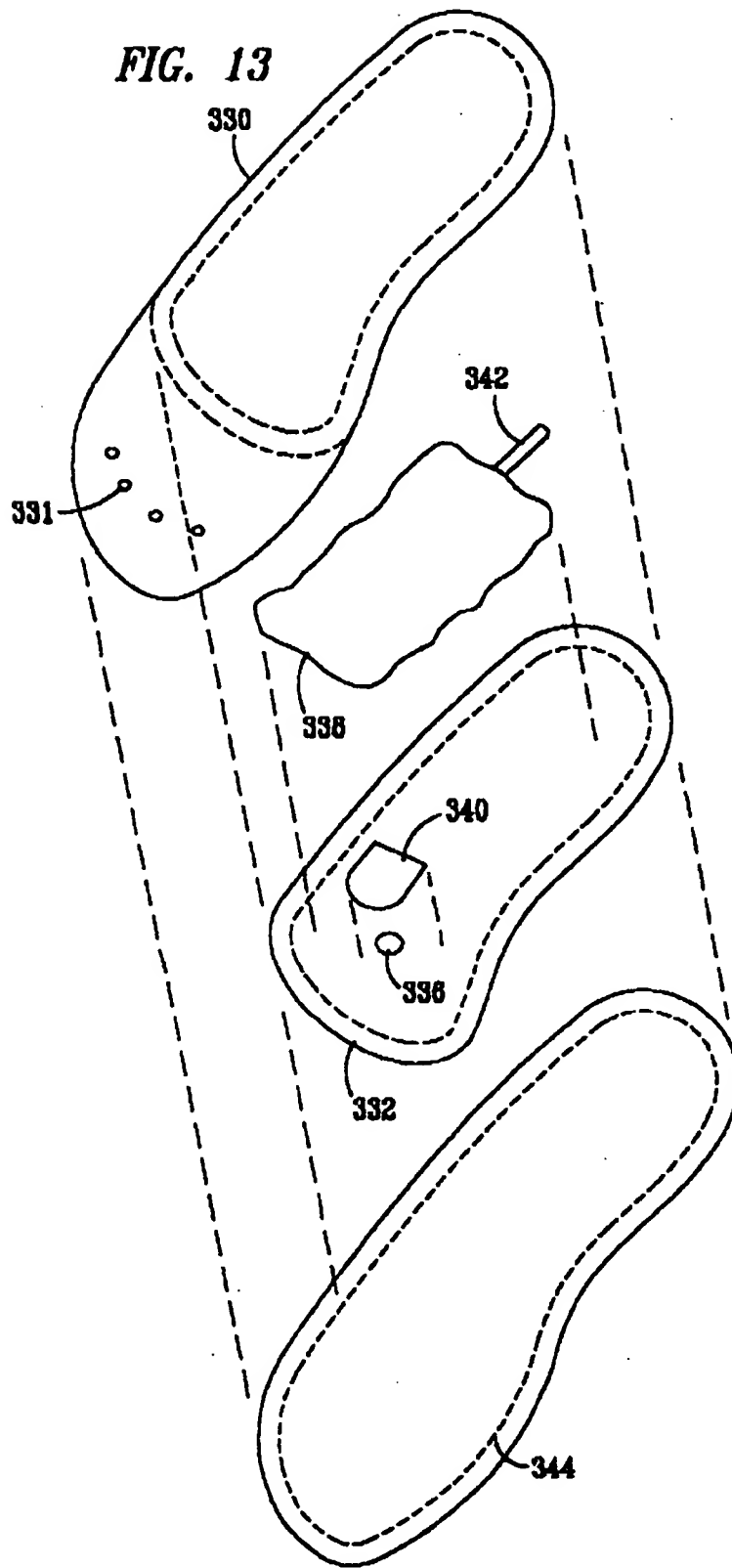


FIG. 10e



*FIG. 11**FIG. 12*



## AIR COOLED SHOE HAVING AN AIR EXHAUST PUMP

### CROSS-REFERENCE TO RELATED APPLICATION

This application is a continuation in part of U.S. patent application Ser. No. 08/325,678, filed Oct. 19, 1994 abandoned, and entitled "AIR COOLED SOLE", abandoned, and continued in U.S. patent application Ser. No. 08/648,861, filed May 6, 1996, and issued as U.S. Pat. No. 5,697,170 on Dec. 16, 1997.

### TECHNICAL FIELD OF THE INVENTION

The present invention relates to a ventilated shoe and, more particularly, to a shoe having an air-pumping device to ventilate the shoe.

### BACKGROUND OF THE INVENTION

Presently known ventilated shoes comprise elastomeric and resilient pads which are made of soft materials, such as sponge or rubber, and contain a plurality of holes in the sole and in the heel of the shoe in order to increase foot comfort. In these types of insoles, it is very difficult to remove moisture and the odor produced as a result of moisture which collects in the shoe due to foot sweating caused by poor shoe ventilation. Since most people use their shoes for long periods of time, it is essential to properly maintain and ventilate the shoes in order to avoid foot diseases, such as, for example, water-eczema.

According to a report of the American Podiatry Association, 75 percent of the males and females stand or walk for 4 hours a day. Such foot stress leads to foot problems, particularly in males, where athlete's foot fungi and the odor associated therewith have become a common problem.

### SUMMARY OF THE INVENTION

The present invention disclosed and claimed herein comprises an air-cooled shoe operable to ventilate the interior of the shoe and the area around a human foot. An outer sole having a toe portion, a ball portion and a heel portion is provided. A shoe upper formed above the outer sole and attached to the outer sole is provided. A pump array is disposed above the ball portion of the outer sole. The pump array includes an air-tight pump cell which is defined by a flexible material and filled with an open cell material which causes the pump cell to expand and fill with air. The pump cell has an air intake disposed on the toe portion of the outer sole and an air exhaust connected to the outside ambient air. A semi-rigid layer is disposed over the entirety of the pump array. Two one-way valves are disposed in a detachable pod which allow air to enter the pump array in one direction and to exit the pump array in one direction.

In another aspect of the present invention, the pump cell has an intake/exhaust having a first and second end, with the first end connected to the pump cell and the second end connected to the one-way valve, allowing air to exit only through the exhaust and another one-way valve allowing air to enter only through the intake.

In a further aspect of the present invention, a first one-way valve is disposed along an air inlet and a second one-way valve is disposed along an exhaust. The first one-way valve allows air to enter the pump cell only through the inlet and the second one-way valve allows the air to exit only through the exhaust.

In yet a further aspect of the present invention, a shutoff valve may be disposed along the air intake for stopping air and liquid from passing through the air intake.

In yet a further aspect of the present invention, the air intake may be attached to a filtering device for filtering out large particles which are too large to be carried through the pump.

### BRIEF DESCRIPTION OF THE DRAWINGS

For a more complete understanding of the present invention and the advantages thereof, reference is now made to the following description taken in conjunction with the accompanying Drawings in which:

FIG. 1a illustrates a cutaway view of the system of the present invention;

FIG. 1b illustrates a top view of the system of the present invention;

FIG. 1c illustrates a side cross-sectional view of the system of the present invention;

FIG. 1d illustrates a side cutaway view of the system of the present invention;

FIG. 2a illustrates an exploded diagram of the construction of the pump cells;

FIG. 2b illustrates a cross-sectional view of an assembled pump cell;

FIG. 2c illustrates a perspective view of the pump cell;

FIG. 3a illustrates an alternative embodiment of the present invention;

FIG. 3b illustrates a cross-sectional view of an alternative embodiment of the present invention;

FIG. 4a illustrates a cutaway drawing of a shoe insert utilizing the system of the present invention.

FIG. 4b illustrates a perspective view of the shoe insert utilizing the system of the present invention;

FIG. 5 illustrates a side cutaway view of the ventilated shoe;

FIG. 6a illustrates a top view of the ventilated shoe with the upper and the inner sole removed;

FIG. 6b illustrates a cutaway view of the valve pod;

FIG. 7 illustrates a schematic diagram of the ventilated shoe and valve pad;

FIG. 8a illustrates a top cutaway view of an additional embodiment of a ventilated shoe with the shoe upper and inner sole removed;

FIG. 8b illustrates a cutaway view of a valve pod;

FIG. 9 illustrates a schematic diagram of the additional embodiment of the ventilated shoe and valve pad;

FIG. 10a illustrates a top view of a yet further embodiment of a ventilated shoe with the upper removed;

FIG. 10b illustrates a finished insole;

FIG. 10c illustrates a composite spring material which may replace the open cell foam;

FIG. 10d illustrates an alternate composite spring material;

FIG. 10e illustrates a top view of a molded insole and takes the portion thereof which is molded;

FIG. 11 illustrates a molded pump and hoses;

FIG. 12 illustrates two molded flat valves; and

FIG. 13 illustrates a membrane pump with integrated intake.

### DETAILED DESCRIPTION OF THE INVENTION

Referring now to FIG. 1a, there is illustrated a cutaway view of the system of the present invention. A sole 12 is

provided as part of an overall shoe (not shown). An outer sole 14 is provided and is roughly in the shape of a human foot (not shown), which fits over the top of the sole 12. A heel pad 16 is disposed on the top of the outer sole 14 and covers the rear one-third area of the outer sole 14. Toe impressions 18 are provided at the front edge of the outer sole 14. The toe impressions 18 are slightly impressed areas of the outer sole 14 and are placed to coincide at the locations of the toes of a human foot (not shown), when placed over the sole 12. A front pump cell 20 is provided and is placed on top of the outer sole 14, such that it corresponds to the head of the metatarsus of the first shaft of the human foot and of the second shaft of the human foot, extending approximately halfway up the first and second shafts from the head towards the base. A right pump cell 22 is provided and placed above the outer sole 14. The right pump cell 22 corresponds to the area between the head and the base of the metatarsus of the third, fourth, and fifth shaft. A rear pump cell 24 is provided and placed on top of the outer sole 14. The location of the rear pump cell 24 corresponds to the location of the base of the metatarsus of the first and second shaft to midway between the base and the head of the metatarsus of the first and second shaft.

An intake manifold 26 is provided and located between the toe impressions 18 in the front of the front pump cell 20 and the right pump cell 22. The intake manifold 26 is located such that it coincides the phalanges of the first through fifth shaft of the human foot. A front intake reed 28 is provided on the left side of the intake manifold 26 and is connected through a front intake tube 30 to the front pump cell 20. A rear intake reed 40 is provided in the center of the intake manifold 26 and is connected by a rear intake tube 42 to the rear pump cell 24. A right intake reed 34 is provided on the right side of the intake manifold 26 and is connected by the right intake tube 36 to the right pump cell 22. The intake reeds 28, 40 and 34 allow air to flow only in one direction into the pump cells 20, 22 and 24. An exhaust manifold 46 is provided and placed on the outer sole 14 of the sole 12. The exhaust manifold 46 is located under the arch of the human foot. Located on the upper portion of the exhaust manifold 46 is a front exhaust reed 48. The exhaust reed 48 is connected to the front pump cell 20 by a front exhaust tube 32. Located in the center of the exhaust manifold 46 is a rear exhaust reed 50. The rear exhaust reed 50 is connected to the rear pump cell 24 by a rear exhaust tube 44. Located on the lower portion of the exhaust manifold 46 is a right exhaust reed 52. The right exhaust reed 52 is connected to the right pump cell 22 by a right exhaust tube 38. The exhaust reeds 46, 50 and 52 allow air to pass through them in only one direction, that is, from the exhaust tubes 32, 44 and 38. The exhaust manifold 46 has one outlet into the outside air which is connected to a tube 54 to pass through the outer sole 14 of the sole 12.

Referring now to FIG. 1b, there is illustrated a top view of the sole 12. The top layer of the sole 12 is a pad 62 running the full length of the sole 12 covering the outer sole 14. This pad 62 is the same shape as the outer sole 14. A semirigid layer 60 is located just beneath the pad 62 in an area covering the pump cells (not shown). A raised area 64 is located on the top of the pad 62 and coincides with an area just under the base of the phalanges of the first through the fifth shaft of the toes of the human foot. Disposed in the raised area 64 are intake holes 66. These holes 66 perforate the pad 62 to allow air to pass from the air around the foot through the intake holes 66 to the intake manifold 26 (not shown) located just beneath the intake holes 66. The semirigid layer 60 is used to support the foot while allowing the

foot to press down against the pump cells (not shown). The heel pad 16 is shown underneath the pad 62.

Referring now to FIG. 1c, there is illustrated a sectional view of the system of the present invention. The outer sole 14 is shown extending from the rear of the shoe across the bottom of the rear of the sole 12 running the full length of the sole 12. The heel pad 16 is shown passing from the rear of the outer sole 14 one-third of the length of the outer sole 14. The exhaust manifold 46 is shown containing the front exhaust reed 48, the rear exhaust reed 50, and the right exhaust reed 52. The rear pump cell 24 is shown, as is the front pump cell 20. The intake manifold 26 is shown. Placed above the front air cell 20 and the rear air cell 24, the semirigid layer 60 runs from the front pump cell 20 to the rear of the exhaust manifold 46. Covering the full length of the sole 12 from the rear of the heel pad 16 to the front of the outer sole 14 is the pad 62. The toe impressions 18 are shown disposed in the pad 62. The raised area 64 is shown just behind the toe impressions 18. The intake holes 66 are shown perforating the pad 62 and disposed in the area of the raised area 64. The intake holes 66 are also disposed just above intake manifold 26. Also shown is the open-celled foam 70 located inside the front pump cell 20 and the rear pump cell 24.

Referring now to FIG. 1d there is illustrated a side cutaway view of the system of the present invention. The outer sole 14 is shown running from the front of the human foot to the rear of the human foot 80. A typical tennis shoe upper 82 is shown connected to the outer sole 14. The tennis shoe upper contains laces 84, a tongue 86, a collar 88, and a body 90. The shoe has vents 92 placed in the toe area. The pad 62 is shown running from the heel of the foot 80 to the toes of the foot 80. The raised area 64 is shown positioned under the base phalanges of the foot 80. Intake holes 66 are shown disposed in the pad 62 at the raised area 64. The intake manifold 26 is shown disposed directly beneath the intake holes 66. The front pump cell 20 is shown disposed directly in front of the rear pump cell 22. The exhaust manifold 46 is shown having the front exhaust reed 48, the rear exhaust reed 50, and the right exhaust reed 52 disposed therein. The heel pad 16 is shown disposed between the foot 80 and the outer sole 14. The semirigid layer 60 is shown disposed between the pad 62 and the front pump cell 20 and the rear pump cell 24.

In operation, the human foot (not shown) fits over the sole 12. The human foot is outlined by the outer sole 14. The heel of the human foot fits over the heel pad 16 with the five toes of the human foot each fitting into a corresponding one of the toe impressions 18. The front intake reed 28, the rear intake reed 40, and the right intake reed 34 allow air to pass in only one direction from the interior of the shoe into the tubes 30, 42, and 36. The front exhaust 48, the rear exhaust reed 50, and the right exhaust reed 52 also allow air to pass in only one direction that being from the exhaust tubes 32, 38, and 44 through the outside exhaust tube 50. Therefore, when the pressure of the foot (not shown) is not pressing on the front pump cell 20, the right pump cell 22, and the rear pump cell 24, the open-celled foam 70 inside the pump cells 20, 22, and 24 causes the pump cells 20, 22, and 24 to expand, thereby drawing air through the intake manifold 26 and through the intake reeds 28, 40, and 34, through the intake tubes 30, 42, and 36, and into the pump cells 20, 22, and 24. This draws air from the interior of the shoe and around the foot into the front pump cell 20, the rear pump cell 24, and the right pump cell 22.

When a person steps with his foot onto a surface, the foot then presses down on the pad 62, the front pump cell 20, the

right pump cell 22, and the rear pump cell 24. This compresses the pump cells 20, 22 and 24 and compresses the open-celled foam 70 inside the pump cells 20, 22 and 24. This, in turn, causes the air from the front pump cell 20 to be expelled through the front exhaust tube 32, through the exhaust reed 48, and thereby through the outside exhaust tube 54. This also causes air from the right pump cell 22 to be expelled through the right exhaust tube 38, through the right exhaust reed 52, and through the outside exhaust tube 54. Finally, this causes air inside the rear pump cell 24 to be expelled through the tube 44, through the rear exhaust reed 50, and through the outside exhaust tube 54 into the outside ambient air. This happens with each step.

After a person lifts his foot off the ground to take another step, the air is drawn through the intake reeds 28, 40 and 34, through the intake tubes 30, 36 and 42, and into the pump cells 20, 22 and 24. Air is only drawn through the intake reeds 28, 30 and 44, and not through the exhaust reeds 48, 50 and 52, because air can only be expelled out of the exhaust reeds 48, 50 and 52 in the direction of the outside exhaust tube 54 from the pump cells 20, 22 and 24. Once the pump cells 20, 22 and 24 are filled with air when a person steps onto a surface, the foot presses down on the pump cells 20, 22 and 24, pressing them against the outer sole 14 of the sole 12, causing the pump cells 20, 22 and 24 to be compressed and the air to be expelled through the tubes 32, 42 and 38, through the exhaust reeds 48, 50 and 52, and through the outside exhaust tube 54 into the outside ambient air.

This system, comprising multiple pump cells 20, 22 and 24, and multiple intake reeds 28, 34 and 40, provides consistent air transfer during changing foot positions and walking due to the multiple pump cells 22, 24 and 20 and the semirigid layer 60 placed over the pump cells 20, 22 and 24. Since the pump cells 20, 22 and 24 each have individual intake reeds 28, 40 and 34, individual intake tubes 30, 42 and 36, individual exhaust tubes 32, 44 and 38, and individual exhaust reeds 48, 50 and 52, this allows the individual pump cells 20, 22 and 24 to operate independently from each other. This also causes increased service life due to the fact that the failure of the exhaust reeds 46, 50 and 52 is the most probable cause of system malfunction. Since each pump cell 20, 22 and 24 has its own exhaust reed 46, 50 and 52, the rate of reduction is fractional, since it is unlikely that all of the exhaust reeds 46, 50 and 52 will fail simultaneously.

Referring now to FIG. 2a, there is illustrated an exploded diagram of the construction of a pump cell 98. The pump cell 98 consists of a plastic tube inlet 104, a plastic tube outlet 106, a main tubing 100, and an open-celled foam filler 102. Referring now to FIG. 2b, there is illustrated a longitudinal section view of an assembled pump cell 98. The plastic tube inlet 104 is shown inserted to the open-celled foam filler 102, which is inserted into the main tubing 100. The plastic tube outlet 106 is shown also inserted into the open-celled foam filler 102. Referring now to FIG. 2c, there is illustrated a perspective view of the pump cell 98. The open-celled foam filler 102 is shown inside the main tubing 100, with the plastic tube inlet 104 inserted through the main tubing 100 into the open-celled foam filler 102. The plastic tube outlet 106 is shown inserted into the open-celled foam filler 102 and through the main tubing 100.

In operation, the open-celled foam filler 102 is normally in an expanded position as shown in FIG. 2b, such that it holds the two sides of the main tubing 100 apart from each other. This in turn traps air in the open-celled foam filler 102. Air comes in through plastic tube inlet 104. The air may only flow inward through plastic tube inlet 104 and may only flow

out through plastic tube outlet 106. When the main tubing 100 is compressed by a human foot (not shown), the open-celled foam filler 102 is compressed together and the two sides of the main tubing 100 move towards each other. This in turn causes the air inside the open-celled foam filler 102 to be expelled through the plastic tube outlet 106.

Referring now to FIGS. 3a and 3b, there is illustrated an alternative embodiment of the present invention. An outer sole 110 is shown approximately in the shape of an outline of a human foot. A heel pad 112 is shown covering the rear one-third of the outer sole 110. An intake grille 114 is provided. A pump bladder 116 is provided and is filled with an open-celled foam 118. The pump bladder 116 is connected to the intake grille 114 through an inlet reed 124. An exhaust port 120 is provided and is connected to the pump bladder 116 through an outlet reed 126. A pump lever 128 is provided and runs from below the heel pad 112 up to the intake grille 114. Pump return springs 122 are provided and positioned between the outer sole 110 and the pump lever 128. The pump lever 128 is positioned such that it is directly above the pump bladder 116. A semirigid layer 132 (not shown in FIG. 3a) is then positioned above pump lever 128, and a pad 130 (not shown in FIG. 3a) is positioned above the heel pad 112. The semirigid layer 132 runs the full length of the outer sole 110 from the front of the outer sole 110 to the rear of the outer sole 110. Intake holes 134 are disposed in the pad 130 running through the full height of the pad 130.

In operation, when a human foot is not pressing upon the pad 130, this allows the open-celled foam 118 inside the pump bladder 116 to expand, drawing air from around the toes of a human foot, through the intake holes 134, through the intake grille 114, through the inlet reed valve 124, and into the pump bladder 116. When the human foot is pressed down on the pad 130, it pushes the semirigid layer 132 down upon the pump lever 128, which compresses the open-celled foam 118 in the pump bladder 116 and expels the air in the pump bladder 116 through the outlet reed 126, and then through the exhaust port 120. When pressure is released from the pump lever 128, the pump lever is raised by the pump return springs 122, such that the open-celled foam 118 in the pump bladder 116 may expand to draw in air.

Referring now to FIG. 4a, there is illustrated a cutaway drawing of a shoe insert 148 utilizing the system of the present invention. The shoe insert 148 consists of a base 150. The insert 148 also consists of an intake manifold 152. The intake manifold 152 is connected to a main pump cell 156 through an intake reed 154 which allows air to travel only from the direction of the intake manifold 152 to the main pump cell 156. The main pump cell 156 has semirigid walls and is expanded by leaf springs 158 disposed on the interior of the main pump cell 156. The main pump cell 156 is connected to a secondary pump cell 162 through a first exhaust reed 160, which allows air to flow only in the direction from the main pump cell 156 to the secondary pump cell 162. An exhaust tube 164 is connected to the secondary pump cell 162. The exhaust tube 164 has disposed near its end a second exhaust reed 166 allowing air to flow only from the secondary exhaust bladder 156 and not into the secondary exhaust bladder 156. A tube 168 is connected to the outward side of the second exhaust reed 166.

Referring now to FIG. 4b, there is illustrated a perspective view of the complete insert 148. A pad 172 is disposed over the full length of the base 150. Disposed in the pad 172 near the front of the pad 172 are intake holes 170. The intake holes 170 allow air from around the toes of the foot to travel through the pad 172 to the intake manifold 152.

In operation, the insert 148 can be disposed inside a normal athletic shoe between the foot of the wearer and the

sole of the shoe. Once the insert 148 is inserted into a normal athletic shoe between the foot of the wearer (not shown) and the sole of the athletic shoe, the secondary pump cell 162, and the main pump cell 156 are filled with air. When a person first steps down with their heel, their foot presses the air out of the secondary pump cell 162, through the exhaust tube 164, out the second exhaust tube 166, and out the outlet tube 168. When a person rolls onto the ball of their foot, air is expelled from the main pump cell 156, through the exhaust reed 160, and into the secondary exhaust cell 162. When a person then completes his step and lifts his foot off of the ground, the leaf springs 158 in the main pump cell 156 expand the main pump cell 156, drawing air through the intake holes 170 from around the toes of the human foot (not shown), into the intake manifold 152, through the intake reed 154, and into the main pump cell 156. Then the cycle starts over again with the person expelling the air from the secondary pump cell 162, and then expelling the air from the cell 156 into the secondary exhaust cell 162 as stated above.

Referring now to FIG. 5, there is illustrated a side cutaway view of the system of the present invention. A ventilated shoe 200 is shown. A human foot 202 is provided and is disposed inside the ventilated shoe 200. An outer sole 204 is provided. A typical tennis shoe upper 216 is shown connected to the outer sole 204. The tennis shoe upper contains laces 218, a tongue 220, a collar 222 and a body 224. The ventilated shoe 200 has vents 226 disposed in the toe area. A pump cell 210 is disposed between the human foot 202 and the outer sole 204. Disposed inside the pump cell 210 is open-cell foam 212. The pump cell 210 is disposed in the inner sole 208. Also disposed in the inner sole 208, near the toe portion of the human foot 202, is a filter 214. Connected to the filter 214 is an intake tube 228. The intake tube 228 runs from the filter 214 along the pump cell 210 to the midsection of the human foot 202. A valve pod 230 is disposed near the midsection of the outer sole 204. The valve pod 230 contains two one-way valves, one valve being an intake valve 242 and the other valve being an exhaust valve 244 (shown in FIG. 6b). The intake tube 228 is connected to the inlet of the intake valve 242. The outlet of the intake valve 242 is connected to the pump cell 210. The inlet of the exhaust valve 244 is connected to the pump cell 210 and the outlet thereof is connected through an opening 232 to the outside ambient air. A heel pad 206 is disposed in the inner sole 208 between the valve pod 230 and the rear of the shoe 200.

Referring now to FIG. 6a, there is illustrated a top view of the ventilated shoe 200 with the upper 216 and the inner sole 208 removed. The outer sole 204 is shown having the shape of an outline of the human foot 202 (shown in FIG. 5). The heel pad 206 is disposed on top of the outer sole 204 and covers the rear one-third area of the outer sole 204. The pump cell 210 is shown disposed on the outer sole 204. Intake tube 228 is shown extending from the toe portion of the outer sole 204 to exit the outer sole 204 at the midsection. The pump intake tube 232 is shown with one end connected inside the pump cell 210 and the other end extending outward from the outer sole 204 near the area where the intake tube 228 extends from the outer sole 204. An exhaust tube 234 is disposed such that it extends from inside the pump cell 210 to the outside of outer sole 204 in the approximate area of the pump intake tube 232. Proximate to the area where the intake tube 228, the pump intake tube 232, and the exhaust tube 234 exit, the outer sole 204 may be recessed such that the area is indented into the outer sole 204.

Referring now to FIG. 6b, there is illustrated a cutaway view of the valve pod 230. The valve pod 230 contains an

intake valve 242 and an exhaust valve 244. The intake valve 242 and the exhaust valve 244 allow air and liquid to pass in only one direction from the inlet to the outlet. The inlet A of the intake valve 242 is connected to the outlet A of the intake 228. The outlet B of the intake valve 242 is connected to the open end B of pump intake tube 232. The inlet C of the exhaust valve 244 is connected to the second end C of the exhaust tube 244 and the outlet of the exhaust valve 244 is connected to the outside ambient air. The valve pod 230 is thus located on the outside of the outer sole 204 of the ventilated shoe 200. This allows for easy cleaning and replacement of the valve pod 230. The pump cell 210 may be bonded together by adhesives exclusively, or may be bonded by heat means. The outlet side of the exhaust valve 244 may be fitted with a charcoal filter or condenser, as needed. The pump intake tube 232 may be located at the left rear of the pump cell 210, as shown in FIG. 6a, or it may be located at the extreme rear of pump cell 210, or at the front of pump cell 210. It does not matter where the pump intake tube 232 or the exhaust tube 234 connects to pump cell 210.

Referring now to FIG. 7, there is illustrated a schematic diagram of the apparatus shown in FIGS. 6a and 6b. The pump cell 210 is shown having the pump intake tube 232 connected thereto and the exhaust tube 234 also connected thereto. The intake tube 228 is shown connected to the inlet of intake valve 242. The outlet of intake valve 242 is connected to the pump intake tube 232 whose opposite side is connected to the pump cell 210. The opposite side of exhaust tube 234 is connected to the inlet of exhaust valve 244. The outlet of exhaust valve 244 is connected to the outside ambient air.

In operation, the human foot 202 fits over the outer sole 204 and into the upper 216 of the ventilated shoe 200. The heel of the human foot 202 fits over the heel pad 206. The toes of the human foot fit into the front of the ventilated shoe 200 with the arch between the toes and the foot fitting just over the filter 214. Air is allowed to pass through the filter 214, through the intake tube 228, through the intake valve 242, and through the pump intake tube 232 and to the pump cell 210. This is allowed to happen when the human foot 202 is not exerting pressure on the pump cell 210 and the open-cell foam 212 in the pump cell 210 expands the pump cell 210. This draws air from the interior of the shoe 200 into the pump cell 210. The intake valve 242 only allows air to pass from the intake tube 228 into the pump intake tube 232 in that particular direction. Air is not allowed to pass from the pump cell 210 through the pump intake tube 232 into the intake tube 228. Moisture and liquid, along with air, may be drawn through the filter 214 and into the pump cell 210. Air is then drawn into the shoe 200 through the vents 226 and around the collar 222 to replace the air that is drawn through the filter 214 into the pump cell 210.

When pressure is exerted from the human foot 202 onto the outer sole 204, the pump cell 210 is compressed by the pressure. This in turn compresses the open-cell foam 212 which is inside the pump cell 210. This causes the air or water vapor from the pump cell 210 to be expelled through the exhaust tube 234 and pass through the one-way exhaust valve 244 into the outside ambient air. The exhaust valve 244 does not allow air or liquid from the outside to pass through the exhaust valve 244 into the exhaust tube 234, thereby entering the pump cell 210. When the human foot 202 is then lifted off the ground, the air is once again drawn through the filter 214 through the intake tube 228, through the intake valve 242, and through the pump cell 244 and into the pump cell 210. A cut-off valve (not shown) may be added between the filter 214 and the intake valve 242 along the

intake tube 228. If the cut-off valve is activated, the air will no longer be drawn from the area around the human foot 202.

Referring now to FIG. 8a, there is illustrated a top cutaway view of an additional embodiment of a ventilated shoe 248 with the shoe upper and inner sole removed. An outer sole 250 is provided having a shape of an outline of the human foot 202. A heel pad 252 is disposed on top of the outer sole 250 and covers a rear one-third area of the outer sole 250. A pump cell 254 is shown disposed on the outer sole 250 covering an area from approximately the toe area of the outer sole 250, along two-thirds of the outer sole 250, and also covering nearly the full width of the outer sole 250. An intake tube 258 is disposed to extend from the toe portion of the outer sole 250 and has an outlet D to the midsection of outer sole 250. A monotube 260 is disposed running from the interior of the pump cell 254 through the outer sole 250 to exit the outer sole 250 at port E, adjacent to the intake tube 258. The monotube 260 may be located at the rear, sides, or front of the pump cell 254. Also, the pump cell 254 may be confined to just the toe section of the outer sole 250, or may run throughout the entire surface area of the outer sole 250. Both the intake tube 258 and the monotube 260 may be merely passages between the pump cell 254 and either the interior of the shoe with respect to intake tube 258 and the exterior of the shoe with respect to monotube 260. The intake tube 258 and the monotube 260 exit the outer sole 250 and are recessed such that the area is indented in the side of the outer sole 250. An open-cell foam 256 or other expandable material may be used to fill the pump cell 254, such that when pressure is released from on top of the pump cell 254, the open-cell foam 256 will expand the pump cell 254.

Referring now to FIG. 8b, there is illustrated a cutaway view of a valve pod 262. An intake valve 264 is disposed in valve pod 262. Intake valve 264 has an inlet D and an outlet E. The inlet D of the valve 264 is connected to the outlet D of intake tube 258. The outlet E of the intake valve 264 is connected to the monotube 260. An exhaust valve 266 is also provided and disposed in the valve pod 262. The exhaust valve 266 has an inlet E and an outlet F. The outlet F of the exhaust valve 266 is open to the outside air through the side valve pod 262. The inlet E of exhaust valve 266 is connected to monotube 260, and is also the same port as the outlet E of the intake valve 264. The valve pod 262 fits in the recessed area of outer sole 250 and connects to intake tube 258 and monotube 260. The intake valve 264 allows air to pass in a one-way direction from intake tube 258, through monotube 260 and into pump cell 254. The exhaust valve 266 allows air to pass in a one-way direction from pump 254, through monotube 260, and through the exhaust valve 266.

Referring now to FIG. 9, there is illustrated a schematic diagram of the apparatus shown in FIGS. 8a and 8b. The pump cell 254 is shown having a monotube 260 connected thereto. The intake tube 258 is shown connected to the inlet D of the intake valve 264 of the valve pod 262. The outlet E of intake valve 264 is connected to the monotube 260. The inlet E of the exhaust valve 266 of the valve pod 262 is also connected to the monotube 260 with the outlet F of exhaust valve 266 connected to the outside ambient air. The opposite end of monotube 260 is connected to pump cell 254.

In operation, the human foot fits over the outer sole 250 and into the upper of the ventilated shoe 248. The heel of the human foot 202 fits over the heel pad 252. The toes of the human foot 202 fit into the front of the ventilated shoe 248, over the front of the outer sole 250 with the arch between the toes and the foot fitting just over a filter (not shown), which

is positioned just over the inlet of inlet tube 258. When pressure is released from the pump cell 254 and the open-cell foam 256 inside the pump cell 254 causes the pump cell 254 to expand, air is drawn through the filter and into the inlet of intake tube 258. The air and/or liquid then passes through intake valve 264 and through the monotube 260 into the pump cell 254. Once the open-cell foam 256 is fully expanded and the pump cell 254 is full of air, pressure on the pump cell 254 from the human foot compresses the open-cell foam 256, which is inside the pump cell 254. This, in turn, causes any air or liquid inside the pump cell 254 to pass through the monotube 260 and through the exhaust valve 266 to the outside ambient air. Air and/or water is not allowed to pass from the outside ambient air through the exhaust valve 266 and into the pump cell, nor is air or liquid allowed to pass from the pump cell 254, through the intake valve 264, into the intake tube 258, and thereby into the interior of the shoe 248. A cutoff valve (not shown) may be added between the inlet of the intake tube 258 and the intake valve 264 along the intake tube 228. If the cutoff valve is activated, air will no longer be drawn from the area around the human foot.

The exhaust pressure from the exhaust valve 266 may be used to operate connectivity energy devices, such as a pressured drink bottle or inflatable suspension support devices. Also, the rate at which air or water may be exhausted from the exhaust valve 266 may be regulated, such that a pressure cushion is kept in the pump cell 254 and air is only exhausted when the pressure rises above a given air pressure. This regulated release of the exhaust by restriction of the exhaust opening provides a collapsing cushion with a rate determined by the size of the exhaust passage.

Referring now to FIG. 10a, there is illustrated a top view of a ventilated shoe with the upper removed. In a first step of the production technique to manufacture a sole 250 of the ventilated shoe described above with respect to FIGS. 8a, 8b, and 9, the open-cell foam 256, the intake tube 258, and the monotube 260 are placed in an injection mold for the sole 250. These elements are placed over the sole 250 and in the area to be injection molded to form the insole of the shoe. At this point, closed cell, airtight material (not shown) is forced into the confines of the mold encapsulating the pump foam.

Referring now to FIG. 10b, there is illustrated the finished insole. The closed cell material 26 forms airtight boundaries around the pump cell 254. This also cushions the area above the outer sole 250, as well as enclosing and forming the airtight pump cell 254. The inner sole material 268 also holds the intake tube 258 and the monotube 260 in place. In this process, the open-cell foam 256 defines the pump perimeter before the closed-cell foam 270 is injected into the molding cavity.

Referring now to FIG. 10c, there is illustrated a composite spring material 282 which may replace the open-cell foam 256. The composite spring consists of multilayers 282 using multiple materials. Two open-cell wafers 284 are placed surrounding a closed-cell foam wafer 286. The two open-cell wafers 284 are attached to the closed-cell wafer 286. The closed-cell wafer 286 may be "waffled" or have other shapes to help absorb shock and to return to its original shape.

Referring now to FIG. 10d, there is illustrated an alternate composite spring material 288. An open-cell foam 290 is deposited between two layers of rubber or vinyl extrusion 292 and 294. The layers 292 and 294 may be formed with a semicircular shape as in the extrusion 292 or in a triangular

shape as in the extrusion 294. The space in between 292 and 294 is filled with the open-cell foam 290.

Referring now to FIG. 10e, the area of the injection mold 296 is depicted by hatching.

Referring now to FIG. 11, there is illustrated a molded pump and channels. A midsole 300 is provided. A depression 302 is molded in the midsole. The depression is about one-half the depth of the midsole and runs nearly from side-to-side of the midsole 300. An intake channel 304 is also molded into midsole 300. The intake channel is "T" shaped with the top of the "T" running side-to-side across the toe portion of midsole 300 and the vertical part of the "T" runs into the depression 302. An exhaust channel 308 is also molded into midsole 300. The exhaust channel 308 runs from the rear of the depression 302 to the end of the midsole 300. The depression 302, the intake channel 304, and the exhaust channel 308 are all molded at the time the midsole 300 is molded. Open-cell foam 312 is placed in the molded depression 302 such that half of the open-cell foam 312 rises above the plane of the midsole 300. An airtight flexible membrane 314 is provided having toe channel perforations 316. These toe channel perforations 316 correspond to and are positioned directly over the top of the "T" of intake channel 304.

An intake valve 306 is pressed into intake channel 304. The intake valve 306 allows air to pass from the intake channel 304 into the depression 302. An exhaust valve 310 is pressed into the exhaust channel 308. The exhaust valve 310 allows air to pass from the depression 302 through the exhaust channel 308 and out the rear of the midsole 300. The membrane 314 is bonded over the midsole 300, intake valve 306, exhaust valve 310, exhaust channel 308, intake channel 304, and molded depression 302. The membrane 314 is sealed in an airtight manner to the flat portions of the midsole 300 which were not molded into the channels 308 or 304 or the depression 302.

When pressure is released from the membrane 314, the open-cell foam 312 expands and draws air or water through the toe perforations 316 into the intake channel 304. The air is then drawn through the intake valve 306 and into the depression 302 and open-cell foam 312. When pressure is placed on the membrane 314, air is expelled from the open-cell foam 312 and the depression 302, through the exhaust channel 308, through the exhaust valve 310, and into the outside ambient air. The valve shown in FIG. 11 could be normal one-way air valves or could be molded flap valves as shown in FIG. 12.

Referring now to FIG. 12, there are illustrated flap valves. A single molded flap valve 320 has a single flap 322 which is pressed open from air passing in the direction of arrow 323. If air were to try to attempt to pass in an opposite direction to the direction of the arrow 323, the flap would be held shut and air would not be able to pass through the valve 320. A dual molded flap 324 has two molded flaps 326 and 328. When air is being pressed in the direction of arrow 327, the flaps 326 and 328 are pushed open and air is allowed to pass. When air attempts to move in an opposite direction to the direction of the arrow 327, the flaps 326 and 328 are pressed closed. The flaps 322, 326 and 328 are molded using the same materials and at the same time that the midsole 300 was molded, and would eliminate the need to use separate valves as shown in FIG. 11.

Referring now to FIG. 13, there is an exploded view of a membrane pump with integrated intake. A top layer 320 is provided. The top layer 330 is in the shape of the sole of a human foot running the full length from heel to toe. Toe

perforations 331 are provided in the area that would be under the human toes of the top layer 330. A valve layer 332 is provided running from the end of the heel area approximately two-thirds of the distance to the toe area. The valve layer 332 has disposed in it an intake hole 336. Disposed on top of the intake hole 336 is the flap valve 340. The flap valve 340 is attached to the valve layer 342 such that the flap valve 340 lays directly over the intake hole 336. Open-cell foam 338 is disposed between the valve layer 332 and the top layer 330. Exit tube 342 is disposed in the rear of the foam 338 extending to the rear. The top layer 330 and valve layer 332 are welded together along the perimeter of valve layer 332. The foam 338 and the exit tube 342 are captured in between the top layer 330 and the valve layer 332. A bottom layer 344 is provided and is in the shape of the hole of a human foot. The bottom layer 344 runs the full distance from the heel to the toe area of the human shoe. The bottom layer 344 is then welded to top layer 330. This leaves the forward one-third consisting of the bottom layer and the top layer without having foam in between and the rear two-thirds covered by the top layer 330, the valve layer 332, the foam 338, and the bottom layer 344. The weld between the top layer 330 and the valve layer 332 is an airtight weld forming an airtight cell around the foam 338 in exit tube 342.

In operation, when no pressure is placed on top layer 330, air is drawn through the toe perforations 331, through the intake hole 336, and then through the flap valve 340 into the open-cell foam 338. When pressure is exerted on top layer 330, air is expelled through the exit tube 342.

In summary, there has been provided an air-cooled shoe operable to ventilate the interior of the shoe and the area around a human foot. An outer sole having a toe portion, a ball portion, and a heel portion is provided. A shoe upper is formed above the outer sole and is attached to the outer sole. A pump array is disposed above the ball portion of the outer sole. The pump array includes an airtight pump cell defined by a flexible material and filled with an open-cell material which causes the pump cell to expand and fill with air. The pump cell has an air intake disposed on the toe portion of the outer sole, and an air exhaust connected to the outside ambient air. A semirigid layer is disposed over the entirety of the pump array.

Although the preferred embodiment has been described in detail, it should be understood that various changes, substitutions and alterations can be made therein without departing from the spirit and scope of the invention as defined by the appended claims.

What is claimed is:

1. An air-cooled shoe to be worn on a human foot operable to ventilate an interior of said shoe and the area around the human foot, comprising:

an outer sole having a toe portion, a ball portion and a heel portion;

a shoe upper formed above said outer sole and attached to said outer sole for surrounding the human foot;

said interior of said shoe defined to extend between said outer sole and said shoe upper;

a pump disposed under the human foot, said pump including an air-tight pump cell defined by a flexible material and filled with an expandable material which causes said pump cell to expand and fill with air, said pump cell having a pump intake having a first and a second end with said first end thereof connected to said pump cell, said pump cell also having a pump exhaust having a first and a second end with said first end thereof connected to said pump cell;

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- an air intake having a first and a second end, said air intake being mounted to said shoe such that said first end thereof is disposed proximate to said toe portion of the outer sole, inside said shoe upper, and in fluid communication with said interior of said shoe; 5
- a first one-way valve having an inlet and an exhaust, said first one-way valve being mounted to said shoe such that said exhaust thereof is in fluid communication with the outside ambient air and said inlet thereof is in fluid communication with said second end of said pump exhaust so that air and liquid may flow only from said second end of said pump exhaust to the outside ambient air; and 10
- a second one-way valve having an inlet and an exhaust, said second one-way valve being mounted to said shoe such that said exhaust thereof is in fluid communication with said second end of said pump intake and the inlet thereof is in fluid communication with said second end of said air intake so that air and liquid may flow only from said second end of said air intake to said second end of said pump intake. 15
2. The apparatus of claim 1, wherein said first one-way valve and said second one-way valve are disposed in a pod which is detachably mounted to said outer sole.
3. The apparatus of claim 1, wherein said expandable material comprises multiple layers of multiple materials. 25
4. The apparatus of claim 1, wherein said exhaust of said first one-way valve is restricted, thereby regulating the release of air from said pump, causing said pump cell to collapse slowly. 30
5. The apparatus of claim 1, wherein said pump is activated by the pressure of a human foot pressing against said pump cell and thereby compressing said pump cell, causing air to be expelled through said pump exhaust.
6. The apparatus of claim 1, wherein said expandable material disposed within said pump cell comprises an open cell foam. 35
7. A method of ventilating the interior of the shoe and the area around the human foot, comprising: 40
- drawing air from the interior of the shoe and into an air intake having a first and a second end, the first end of the air intake being disposed proximate to the toe portion of the outer sole, inside the shoe upper, and in fluid communication with the interior of the shoe;

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- pumping air from the air intake to the outside ambient air using a pump disposed under the human foot and mounted to the shoe, the pump including an air-tight pump cell defined by a flexible material and filled with an expandable material which causes the pump cell to expand and fill with air, the pump cell including a pump intake having a first and a second end with the first end thereof in fluid communication with the pump cell, and the second end of the pump intake in fluid communication with the interior of the shoe, the pump cell also having a pump exhaust having a first and a second end with the first end thereof connected to the pump cell; 5
- allowing air and liquid to flow only from the second end of the pump exhaust to the outside ambient air using a first one-way valve having an inlet and an exhaust, the first one-way valve being mounted to the shoe such that the exhaust thereof is in fluid communication with the outside ambient air and the inlet thereof is in fluid communication with the second end of the pump exhaust; and 10
- allowing air and liquid to flow only from the second end of the air intake to the second end of the pump intake using a second one-way valve having an inlet and an exhaust, the second one-way valve being mounted to the shoe such that the exhaust thereof is in fluid communication with the second end of the pump intake and the inlet thereof is in fluid communication with the second end of the air intake. 15
8. The method of claim 7, and further comprising the step of disposing the first one-way valve and the second one-way valve in a pod which is detachably mounted to the other sole.
9. The method of claim 7, wherein the expandable material comprises multiple layers of multiple materials. 20
10. The method of claim 7, and further comprising the step of restricting the exhaust of the first one-way valve, thereby regulating the release of air from the pump, thereby providing a collapsing cushion. 25
11. The method of claim 7, wherein the pump is activated by the pressure of a human foot pressing against the pump cell and thereby compressing the pump cell, causing air to be expelled through the pump exhaust. 30

\* \* \* \* \*

**Appendix C**  
**European Patent Application Number 1,074,193 to Opal Limited**



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(54) **Ventilated footwear**

(57) The ventilated footwear comprises a lower part incorporating a sole, an upper part coupled to the lower part and shaped to receive a foot of a wearer. The upper part has an arch portion and is provided with an inside surface adapted to permit air circulation therethrough, and an outside surface provided with ventilation holes located in the arch portion of the upper part of the footwear. A waterproof and breathable membrane is sandwiched between the inside and outside surfaces in the arch portion of the upper part of the footwear across the holes. Furthermore, an insole is preferably disposed into the footwear. The insole has an arch portion adja-

cently located to the arch portion of the upper part of the footwear. The upper layer of the insole is adapted to permit air circulation therethrough. The insole has a bottom layer provided with transverse intersecting channels extending inwardly from a peripheral edge of the insole. At least one of the channels is adjacent to the holes located in the arch portion of the outside surface of the upper part of the footwear. The channels are provided with openings in communication with the upper layer.

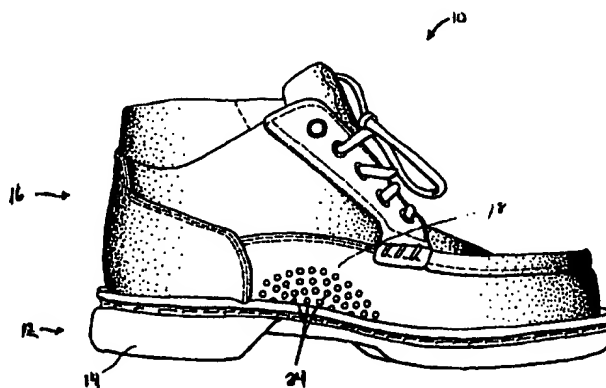


Fig. 1

**EP 1 074 193 A1**

## Description

### Field of the Invention

[0001] The present invention relates to ventilated footwear. More specifically, the present invention relates to footwear having openings in the arch area of the upper, a waterproof and breathable membrane across said openings, and a compressible insole with openings in the top side in communication with channels on the underside which are in communication with the openings in the arch area of the upper for ventilating the interior of a footwear.

### Background of the invention

[0002] Many kinds of footwear, such as athletic shoes, everyday walking shoes, and work boots have the drawback of poor ventilation. The inherent confining of the foot does not allow it to breathe, causing the foot to perspire and thereby promoting the development of bacteria, fungi and the like as well as the accompanying unpleasant odors and skin problems.

[0003] There have been various attempts to solve the problem of ventilating a shoe. A plethora of footwear constructions having various ventilation arrangements are known in the art. Openings in the upper are well known but suffer from the obvious problem of admitting debris and water. Complicated valve arrangements have been suggested by the prior art to close the opening. Many of the approaches have included a pumping means encased within the sole of the shoe, sometimes in communication with the openings in the upper. Generally, the weight of the foot is used to compress a bladder and force air out of apertures to ventilate the foot. Problems have also existed with failure of the bladder to reinflate. The shape and position of the bladder, or air pump, has been such that enough weight is always on it to prevent full inflation. Such mechanisms are typically prohibitively expensive to build into footwear and such complicated multi-component mechanisms are prone to failure and given that most of these prior art devices are built into the shoe, they are not easily repairable or replaceable.

[0004] There are also a variety of other solutions disclosed in order to improve ventilation, such as that disclosed in U.S. Patent No. 5,044,096. In this patent, the outsole is coupled to an insole, in which holes are traversing the thickness of the combined insole/outsole structure. The sole structure has a microporous, waterproof membrane disposed between the insole and the outsole, in order to allow the transpiration of the foot while keeping the foot dry. A primary disadvantage of that systems is that the openings to the exterior of the footwear are generally disposed a substantial part of the time against a surface, and such surface itself may be a source of hot air, for example hot road pavement. Another disadvantage with this solution is that since the

holes for breathing are on the bottom of the outsole, the holes are often blocked by mud, dust or the like debris, resulting in the inefficient operation of the ventilation system.

### Summary of the Invention

[0005] An article of footwear comprising:

- a lower part incorporating a sole,
- an upper part coupled to said lower part and shaped to receive a foot of a wearer, said upper part having an arch portion with a plurality of openings providing communication between the outside of the upper part and the interior of the upper part,
- a waterproof, breathable membrane across the openings, and
- a compressible insole with openings in the top side in communication with channels on the underside which are in communication with the openings in the arch area of the upper part,
- for ventilating the interior of a footwear.

### BRIEF DESCRIPTION OF THE DRAWINGS

[0006] The present invention and its advantages will be more easily understood after reading the following non-restrictive description of preferred embodiments thereof, made with reference to the following drawings wherein:

Figure 1 is a perspective view of a preferred embodiment of the ventilated footwear according to the present invention.

Figure 2 is an exploded view of the arch portion of the footwear.

Figure 3 is an under view of the insole.

Figure 4 is a cross-sectional view of a insole operatively inserted within a footwear.

Figure 5 is a cross-longitudinal view of a channel communicating with the arch portion of the insole of Fig. 3 taken along the line V-V.

Figure 6 is a cross-view of the insole of Fig. 3 taken along the line VI-VI.

Figure 7 is a cross-view of the insole of Fig. 3 taken along the line VII-VII.

### DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0007] With reference to figures 1 to 4, ventilated

footwear (10) according to the present invention comprises a lower part (12) incorporating a sole (14), an upper part (16) coupled to the lower part (12) and shaped to receive a foot of a wearer. The upper part (16) may be of any type of footwear (an athletic shoe, a work boot, a hiking boot, etc.) and may be of any type of material (canvas, leather, synthetic leather, vinyl, plastic, etc.). These materials have a wide range of breathability, but often the construction of the upper part (16), particularly because of the use of adhesives, substantially reduce the breathability of the upper part (16).

**[0008]** The upper part (16) may also have a lining (20) to provide a comfortable interior surface to be in contact with the foot and/or sock of the wearer. Such linings are typically woven or non-woven textiles, and may have wicking properties. The upper part (16) may be treated with oils, silicone or the like to provide water resistant or water proof properties. Of course, such treatments usually interfere with the breathability of the material comprising the upper part. Waterproof and breathable membranes such as that sold under the GORE-TEX trademark are often also used on the inside of the upper part of footwear to provide water resistance with the intention of minimizing the interference with the breathability of the material comprising the upper part (16).

**[0009]** The upper part (16) has an arch portion (18) located on the medial side of the footwear. A plurality of openings (24) are located in the arch portion (18) of the upper part (16) of the footwear on the outside (22) thereof. The greater the number of openings (24) and the larger the openings (24) the greater degree of ventilation may be provided. The openings (24) may be arranged in almost any configuration to satisfy the aesthetic requirements of the design of the footwear. Typically, the openings (24) will be in the order of a few mm in diameter.

**[0010]** A waterproof, breathable membrane (26) larger than the area of the openings (24) is secured to the upper part (16) across the openings. The membrane (26) is preferably made of material such as the material known by the trademark GORE-TEX or another equivalent material. Such material allows air and water vapor to move across it, but does not allow water in liquid form to move across it. In the preferred embodiment of the invention, membrane (26) is secured to the interior (20) of the upper part (16) and may be secured between the upper part and any interior lining, although is contemplated that it may be secured to the exterior of the upper part (16). The membrane (26) may be secured by adhesive about the periphery or adhesive tape or stitched, although stitching may require the stitch holes to be sealed to ensure that the stitch holes do not admit water to the interior of the footwear.

**[0011]** The membrane may also be combined with a lining material which may be particularly advantageous when the membrane is to be disposed on the interior of the upper part with no liner between it and the

foot (or sock over the foot) of the wearer.

**[0012]** Given the usual location and general configuration of the structure of the present invention, the membrane of the preferred embodiment is generally a half circle in shape as shown in Figure 2.

**[0013]** An insole (28) is preferably disposed into the footwear and it is preferably made of a resilient and compressible material, such as polyurethane, although EVA and other such materials may be used. The insole (28) is shaped to fit within the upper part and is contoured to provide a comfortable footbed for the foot of the wearer. Insoles of this type are well known, an example of one such footbed can be found in U.S. Patent No. Des. 290,423. The contouring of the insole includes an arch portion (30) which extends upwardly (see Fig. 4) to provide support and comfort for the medial arch of the foot of the wearer.

**[0014]** In the preferred embodiment of the invention, a plurality of openings (40) are provided substantially vertically through the thickness of the insole (28). As with the openings (24) in the upper part, the greater the number of openings (40) and the larger the openings (40) the greater degree of ventilation may be provided by the invention. The size and shape of the openings (40) are limited only to the extent that the support and comfort function of the insole (28) would be compromised. The openings (40) may be arranged in a variety of configurations, again with consideration of the support and comfort function of the insole in mind, and with consideration of the structure of the bottom side of the insole as discussed below.

**[0015]** In the preferred embodiment of the invention, a lining material (32) preferably made of a quilted textile such as the one known by the trademark CAMBRELLE is secured to the top surface in order to provide a comfortable surface for the foot of the wearer as well as air circulation and wicking properties. An alternative lining material such as kidskin leather may also be employed. In the case where a lining material such as the CAMBRELLE textile is employed, the openings (40) may not have to extend through the lining material; however, in the case where kidskin leather is employed, it is desirable that the openings (40) pass through the lining material in order to maximize breathability.

**[0016]** The bottom of the insole is provided with a plurality of substantially horizontal grooves or channels (36) in register with the substantially vertical openings (40) through the thickness of the insole (28) such that the channels (36) are in communication with the openings (40). The channels may be arranged in a variety of configurations with consideration of the location of the substantially vertical openings (40) through the thickness of the insole (28) as well as the support and comfort function of the insole (28) in mind.

**[0017]** The durometer of the insole (28) material, the thickness of the insole (28), and the depth of the channels (36) should be selected such that when a person walks or runs, the insole (28) should substantially

compress to provide a pumping action but allow the channels (36) to remain open in order to permit adequate air circulation. The weight of the wearer must, of course be taken into account in making such selections. Such selections are within the abilities of one of ordinary skill in the art and the ranges are not particularly different than that generally presently employed.

**[0018]** The plurality of channels (36) are arranged to be in communication with a plurality of channels (42) which extend to the upwardly extending arch portion (30) of the insole (see Fig. 4). These channels (42) are located so as to be in register with the openings (24) in the upper part. In an alternative embodiment of the invention, the channels (42) extending to the upwardly extending arch portion (30) of the insole may terminate in a cavity located in the upwardly extending arch portion (30) underside of the insole (28) and that cavity would be in communication the plurality of the openings (24) in the upper part.

**[0019]** As is apparent from a study of the structure shown and described, upon even the minimal almost imperceptible rocking a person experiences when standing still and even more so in the course of walking, the insole (28) compresses resulting in air being pumped through the channels (36) (42) and through the openings (24) in the upper part. As the wearer's foot is lifted off the ground, and the insole (28) expands to its uncompressed state, low pressure is created within the interior of the upper part and air is thereby drawn into the upper part through the openings (24) therein, through the channels (36) (42). Because of the properties of the membrane (26) across the openings, air carrying water vapor may pass out of the interior of the footwear and fresh air but not water in liquid state or debris may pass into the shoe. The openings (40) through the thickness of the insole permit the circulation of air to extend to that portion of the interior of the footwear above the insole and closer to the foot of the wearer.

**[0020]** The present invention may be provided to a footwear manufacturer or even a shoe repair facility as a kit comprising a template for the openings (24) in the upper part (16), an insole (28) constructed according to the invention and a membrane (26) with adhesive means. As mentioned herein, the present invention may be employed in wide variety of footwear types employing a wide variety of materials. The overall cost of adding the present invention to footwear is low compared to other ventilation schemes.

**[0021]** It should be understood that the present invention relates to a ventilated footwear (10) such as, regular shoes, athletic shoes, outdoor shoes, casual shoes, ski boots and fishing boots, where there is a need to ventilate the foot of a wearer, and is meant to include, but is not limited to: all categories of children's, women's and men's footwear; basketball, football, soccer, tennis, golf, bicycle shoes; skates (ice or inline); cowboy boots; work boots and shoes; military boots and

shoes; nurse's, doctor's and other medical personnel's shoes.

**[0022]** Although the present invention has been explained herein above by way of a preferred embodiment thereof, it should be pointed out that any modification to this preferred embodiment within the scope of the present description is not deemed to alter or change the nature and scope of the present invention, as defined in the appended claims.

**[0023]** Furthermore, according to another aspect of the invention, the channels located on the bottom layer of the insole are transverse intersecting channels extending inwardly from the peripheral edge of the insole and at least one of the channels is adjacent to the holes located in the arch portion of the outside surface of the upper part of the footwear.

### Claims

1. An article of footwear comprising:
  - a lower part incorporating a sole,
  - an upper part coupled to said lower part and shaped to receive a foot of a wearer, said upper part having an arch portion with a plurality of openings providing communication between the exterior of the upper part and the interior of the upper part,
  - a waterproof, breathable membrane across the openings, and
  - a compressible insole having a plurality of channels on the underside which are in communication with the openings in the arch area of the upper part.
2. The article of footwear according to claim 1, wherein said insole further comprises a plurality of substantially vertical openings in register and communication with said channels.
3. The article of footwear according to claim 1, wherein said insole further comprises a textile lining disposed on the upper side.
4. The article of footwear according to claim 1, wherein said insole further comprises an upwardly extending portion in the medial arch area.
5. The article of footwear according to claim 4, wherein said upwardly extending portion in the medial arch area has a plurality of channels in communication with one or more of said channels on the underside of said insole.
6. The article of footwear according to claim 5,

wherein said channels in said upwardly extending portion in the medial arch area are in register and communication with said openings in said upper part.

7. A kit for providing ventilation in an article of footwear, said kit comprising:
  - an insole,
  - an air permeable and water impermeable membrane,
  - adhesive means for securing said membrane to said article of footwear.
8. The kit of claim 7, further comprising a pattern for making openings in the upper part of said article of footwear.
9. The kit of claim 7, wherein said insole comprises a compressible material having a plurality of channels on the underside for communication with the openings in the arch area of the upper part of said article of footwear.
10. The kit of claim 9, wherein said insole further comprises a plurality of substantially vertical openings in register and communication with said channels.
11. The kit of claim 9, wherein said insole further comprises a textile lining disposed on the upper side.
12. The kit of claim 9, wherein said insole further comprises a upwardly extending portion in the medial arch area.
13. The kit of claim 12, wherein said insole wherein said upwardly extending portion in the medial arch area has a plurality of channels in communication with one or more of said channels on the underside of said insole.
14. The article of footwear according to claim 13, wherein said channels in said upwardly extending portion in the medial arch area are to register and communicate with openings in said upper part.
15. An article of footwear comprising:
  - a lower part incorporating a sole,
  - an upper part coupled to said lower part and shaped to receive a foot of a wearer,
  - said part being provided with a plurality of openings providing communication between the exterior of the upper part and the interior of the upper part, and a water proof, breathable

membrane across the openings.

16. An article of footwear according to claim 15, wherein said openings are located in a predetermined area.
17. An article of footwear according to claim 16, wherein said article further comprises a compressible insole having a plurality of channels on the underside which are in communication with the openings in the upper part.
18. An article of footwear according to claim 17, wherein said insole further comprises a plurality of substantially vertical openings in register and communication with said channels.
19. An article of footwear according to claim 17, wherein said insole further comprises a textile lining disposed on the upper side.

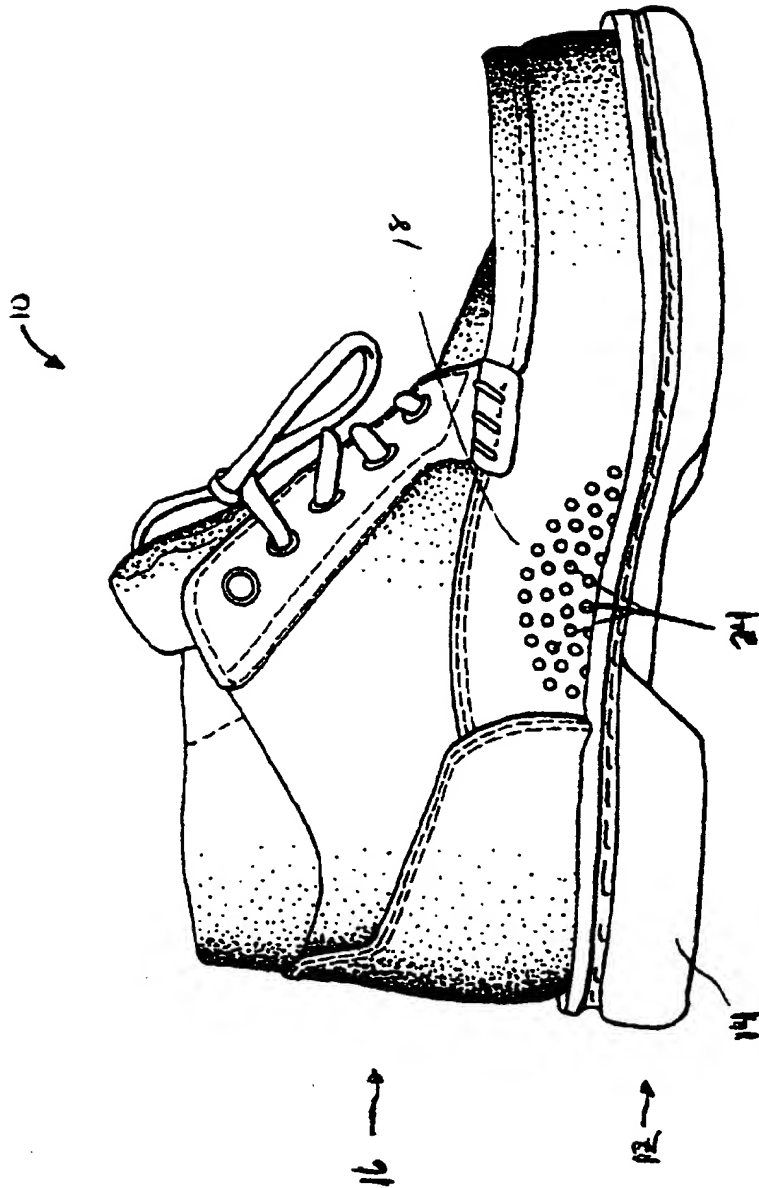


Fig. 1

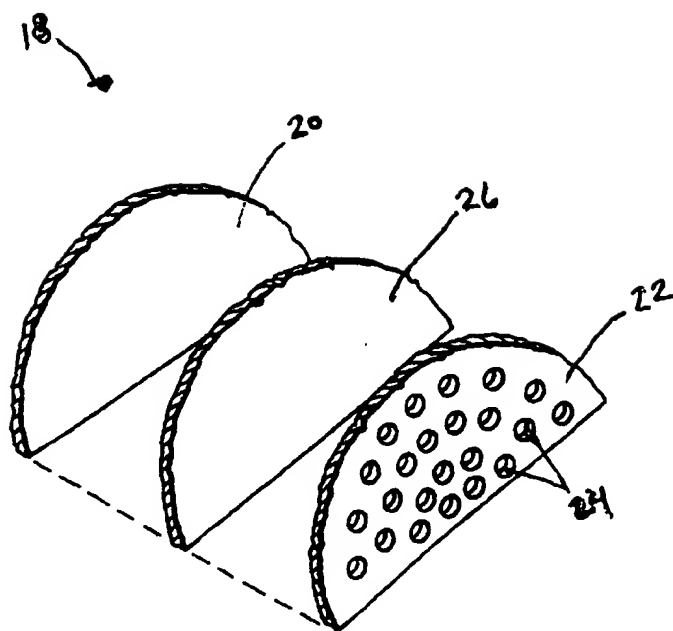


Fig 2

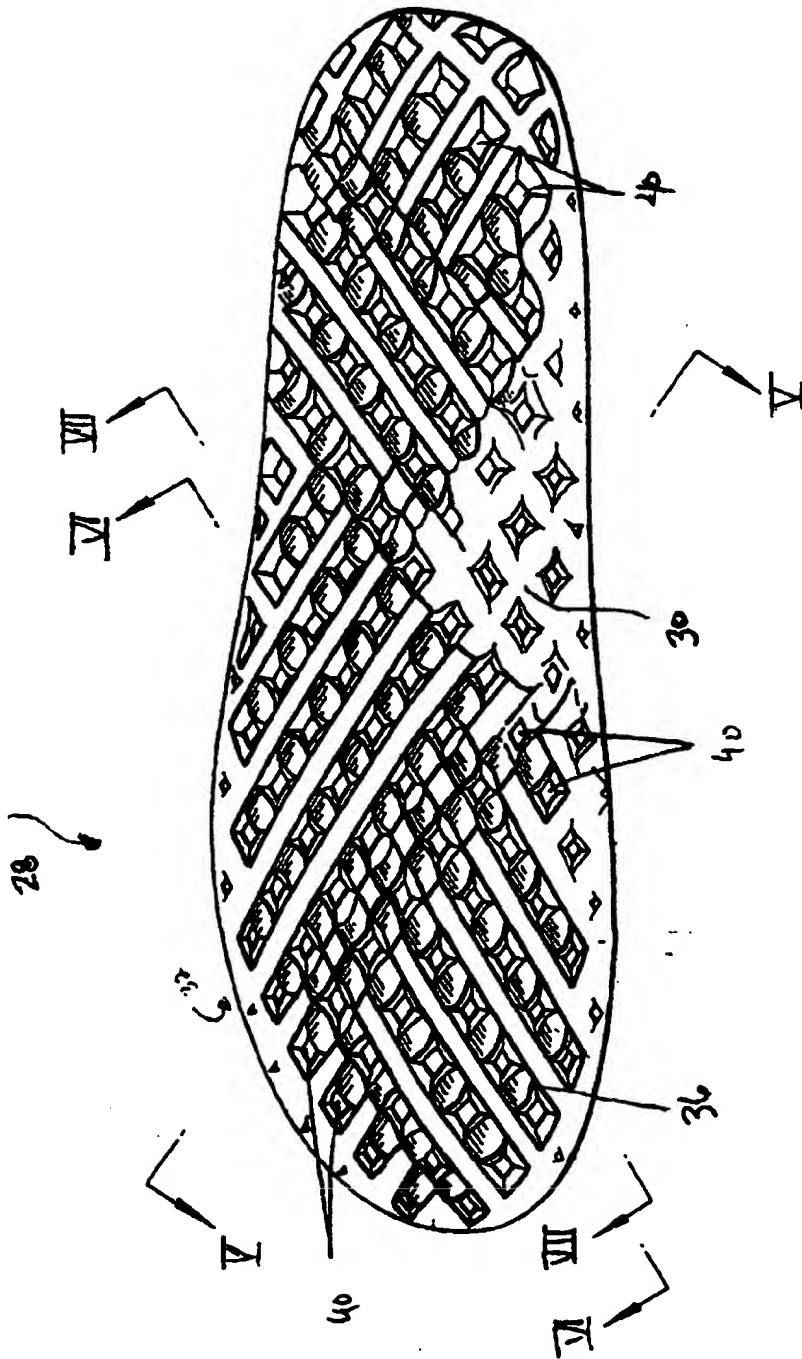


Fig 3

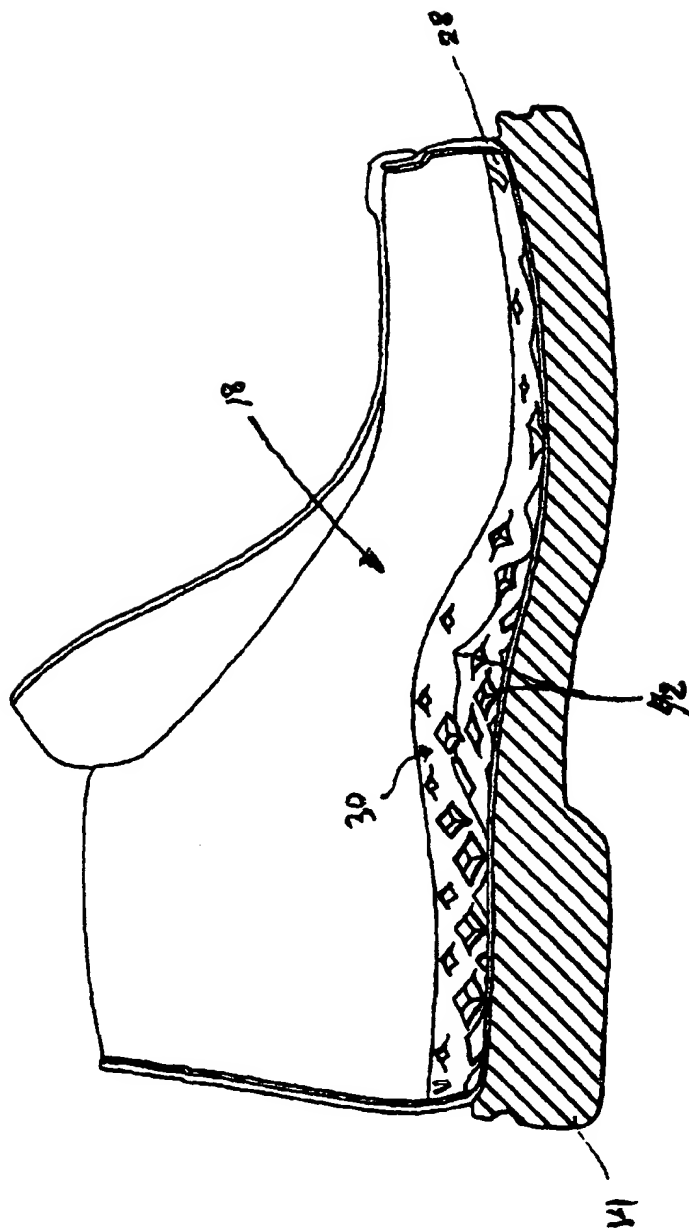
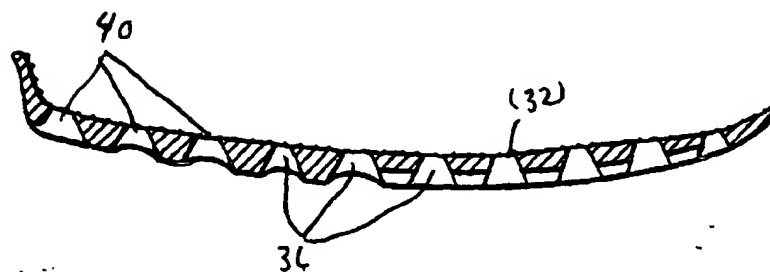
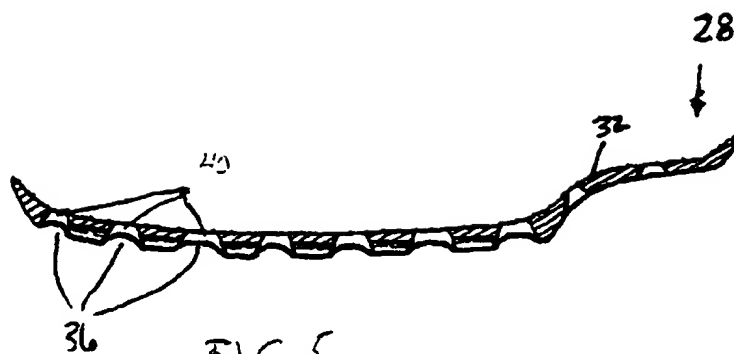


Fig 4





European Patent  
Office

# EUROPEAN SEARCH REPORT

Application Number  
EP 99 40 2866

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
A	BE 534 562 A (J MOYSAN)	7-14	A43B7/12
Y	* claims *	1,2,4-6, 17,18	A43B7/06
A	---	7-14, 28-37	
X	FR 2 116 790 A (LABELLE ET CIE) 21 July 1972 (1972-07-21)	15,16	
Y	* the whole document *	1,2,4-6, 17,18	
X	WO 98 14081 A (ATTILIENI ATTILIO ; STEFCOM SPA (IT)) 9 April 1998 (1998-04-09) * claims 1,4; figures *	7,15,16	
X	EP 0 437 869 A (LEE KYUN CHEOL) 24 July 1991 (1991-07-24) * the whole document *	1,2,4-6, 15-19	
X	EP 0 350 103 A (LEE KYUN CHEOL) 10 January 1990 (1990-01-10) * column 1, line 1 - line 8; claims; figures *	1,2,4-6, 15-19	TECHNICAL FIELDS SEARCHED (Int.Cl.7)
A	US 4 373 274 A (MICHALSKI WILLIAM J) 15 February 1983 (1983-02-15) * column 4, line 52 - line 60 *	7	A43B
A	WO 95 13716 A (BONCORAGLIO ANTONIO) 26 May 1995 (1995-05-26) * the whole document *	1-19	
The present search report has been drawn up for all claims			
Place of search <b>THE HAGUE</b>		Date of completion of the search <b>24 October 2000</b>	Examiner <b>Claudel, B</b>
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			

EPO FORM 1503 03/82 (PocC01)

**ANNEX TO THE EUROPEAN SEARCH REPORT  
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EP 99 40 2866

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.  
The members are as contained in the European Patent Office EDP file on  
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

24-10-2000

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EPO FORM P0456

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

**Appendix D**  
**French Patent Application Number 2,670,369 to Colesnicenco Nicolae**  
**(Original and Translation)**

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(12)

## DEMANDE DE BREVET D'INVENTION

A1

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apparentés :

(71) Demandeur(s) : COLESNICENCO NICULAE — FR.

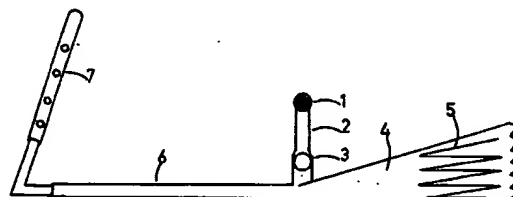
(72) Inventeur(s) : COLESNICENCO NICULAE.

(73) Titulaire(s) :

(74) Mandataire :

(54) Dispositif pour l'aération des pieds, par l'introduction de l'air frais, dans les chaussures fermées.

(57) L'invention concerne un dispositif qui produit un cycle de successions alternatives d'admissions et évacuations d'air frais utilisant la force mécanique du talon, produite pendant la marche. Il est pourvu de: filtre d'air (1), tuyau de liaison (2), soupape d'admission (3), soufflet (4) muni d'un ressort (5), tuyau d'évacuation (6), soupape (7) d'évacuation. Le soufflet (4) est soumis par le talon de l'utilisateur à l'admission de l'air frais alternant avec l'évacuation, grâce aux soupapes (3) et (7), qui font avancer l'air frais à l'intérieur de la chaussure. Le dispositif est destiné à l'industrie de la chaussure utilisé pour éliminer l'odeur déplaisante de la transpiration.



FR 2 670 369 - A1



DISPOSITIF POUR L'AERATION DES PIEDS,  
PAR L'INTRODUCTION DE L'AIR FRAIS, DANS LES CHAUSSURES FERMEES.

La présente invention concerne un dispositif conçu pour l'aérage des pieds dans des chaussures fermées.

Grâce à cette invention on réussit à éliminer totalement le désagrement de la transpiration.

5        Au point de vue des possibilités d'aérage , les chaussures , traditionnellement , sont soit découpées , soit munies des orifices latéraux d'aération ou des perforations , ces possibilités n'étant pas suffisantes pour supprimer l'indésirable transpiration.

10        Le dispositif selon cette invention permet de remédier cet inconvénient.

      Ce dispositif peut être inclus dans le domaine technique de l'industrie du cuir et de la chaussure et, en même temps, il peut faire partie de la production des  
15 petites ateliers.

      Il est possible soit qu'on incorpore le dispositif dans l'ensemble de la chaussure, soit qu'on le confectionne à part et on l'introduise ultérieurement dans la chaussure traditionnelle.

20        Le dispositif selon l'invention comporte les éléments principaux suivants:

- un tuyau vertical d'aspiration prévu en haut d'un filtre;
- une soupape d'aspiration;
- un soufflet pourvu d'un ressort hélicoidal;
- 25 - un tuyau horizontal d'évacuation muni d'une soupape qui s'ouvre au moment d'arrivée de la valeur de la pression de l'air du tuyau orienté horizontalement jusqu'à la valeur établie par des calculs, ça se passant par augmentation

Selon les modalités particulières de la réalisation:

- la soupape d'admission peut faire partie soit du filtre, soit du tuyau d'admission - le tuyau vertical - soit du soufflet de ce dispositif;

- 5        - le soufflet peut être pourvu soit de deux ressorts latéraux situés sur les deux côtés, la côté gauche et la côté droite, du soufflet, soit avec un ressort hélicoidal, situé centralement.

Les dessins annexés illustrent l'invention selon le mode suivant:

- 10       - la figure numéro 1 représente en coupe transversale le filtre du dispositif selon l'invention;

- la figure numéro 2 représente en coupe verticale le tuyau d'aspiration et la soupape d'admission du dispositif selon l'invention;

- 15       - la figure numero 3 représente en coupe transversale le tuyau d'évacuation avec la soupape laquelle fonctionne à une pression constante et avant-déterminée, représenté avec les orifices d'évacuation de l'air de ventilation;

- 20       - la figure numéro 4 représente en coupe transversale le soufflet avec le ressort hélicoidal, à l'intérieur, mis en position centrale;

- la figure numéro 5 représente le dispositif désassemblé ;

- la figure numéro 6 représente en coupe transversale le dspositif selon l'invention;

- 25       - la figure numero 7 représente le dispositif selon l'invention vue d'en haut;

- la figure numero 8 représente la semelle en état de repos;

- la figure numero,9 représentè la semelle tensionnée par le talon.

- 30       En référence à ces dessins, le dispositif comporte:  
le filtre d'air(1), situé au commencement du tuyau vertical  
d'admission(2), qui est pourvu intérieurement d'une soupape  
d'admission(3), laquelle est située en bas, tout près du soufflet(4),  
le soufflet étant muni d'un ressort hélicoidal (5) situé  
35       centralement.

A la continuité du soufflet(4) se trouve le tuyau horizontal d'évacuation(6),prévu d'une soupape d'évacuation (7), ce tuyau se finissant avec des petits orifices (7c) d'évacuation de l'air, ainsi libéré avec pression.

- 5        Le filtre d'air(1),représenté dans la figure 1 comprend:  
         - un manchon du caoutchouc (1a) et un matériel filtrant (1b)  
         comme feutre ou un autre matériel filtrant.

         Le tuyau d'admission(2),représenté dans la figure numero 2, fait la liaison entre le filtre d'air(1)et la soupape d'admission(3).

- 10       Il est cofectionné du caoutchouc.

         La soupape d'admission(3)est fixée à l'intérieur du tuyau vertical d'admission(2) et elle est confectionnée d'un mélange de caoutchouc et plastique.

- La soupape(3)contient à l'intérieur un canal avec conicité (3a)  
15       et une bille de polystiren(3b).

         Dès la soupape(3),représenté dans la figure numéro 2 ,dans le tuyau d'admission,commence le tuyau horizontal d'évacuation(6), muni à l'autre extrémité, de la soupape d'évacuation(7) et représenté avec la soupape et ses orifices dans la figure numéro 3.

- 20       La soupape (7) assure l'évacuation de l'air de ventilation à partir d'une valeur de la pression de l'air du tuyau horizontal (6) établie antérieurement.

         Cette soupape présente un manchon de caoutchouc (7a),un orifice d'obturation(7b) et quatre orifices d'évacuation (7c).

- 25       Le tuyau horizontal d'évacuation(6) se fini avec ces orifices qui assurent la distribution de l'air de ventilation fourni par le système qui réalise le pompage artificiel et conduit l'air du niveau du talon jusqu'au niveau des doigts du pied.

- Le soufflet(4),représenté dans la figure 4 ,est fermé et confectionné d'une surface caoutchoutée ou du caoutchouc mince, ayant fixé  
30       à l'intérieur un ressort hélicoidal(5)centrale et confectionné du fil d'acier. Ce ressort, en état de tension,pendant le fonctionnement du système, s'enfouit dans la masse du soufflet.

- Le principe de fonctionnement de ce dispositif est représenté  
35       par le pompage alternatif de l'air, produit par le mouvement du talon du pied pendant la marche.

Au début, le soufflet(4) se trouve en état de repos et il est rempli de l'air dans son volume entier.

C'est la situation qui caractérise l'état avant de l'introduction du pied dans la chaussure munie de ce dispositif.

5        Au moment de l'introduction du pied dans cette chaussure, le ressort(5) est mis en état de tension et il provoque la diminution du volume du soufflet (4). En cet état, l'air du soufflet(4) est poussé avec pression.

10       Il ferme la soupape d'admission(3) et il prend la direction permise, du tuyau d'évacuation(6), après il rencontre la soupape d'évacuation(7) qui s'ouvre au moment où la valeur de la pression de l'air du tuyau (6), en augmentant, arrive à la valeur obtenue par des calculs.

15       Au moment de la levée du pied pendant la marche, le ressort(5) se détend grâce à l'énergie potentielle accumulée antérieurement, en état de tension, le volume du soufflet commence à augmenter et, à la suite, il a lieu la création d'une dépression dont l'effet c'est l'aspiration de l'air frais et filtré par l'ouverture de la soupape d'admission.

20       Le soufflet s'est ainsi rempli de l'air de ventilation et, quand le talon descend, il exerce une pression sur celui-ci, par laquelle détermine la diminution de son volume et la fermeture de la soupape d'admission(3)

25       L'air de ventilation est obligé de suivre la direction du tube d'évacuation(6) et il arrive à la soupape(7), - cette condition étant concrétisée dans la nécessité de surmonter la résistance opposée par le manchon de caoutchouc(7a), résistance dont la valeur est choisie relativement à la valeur de la pression de l'air avant-déterminée.

30       Ces calculs sont déterminés d'une certaine façon pour que la soupape(7) d'évacuation puisse éliminer l'air de ventilation à une pression d'une valeur plus élevée, ayant comme but la provocation d'une élimination forcée du l'air propre et frais qui pousse à l'extérieur l'air vicié.

Les quatre orifices d'aération (7c) sont placés entre tous les deux doigts du pied pour assurer une aire de diffusion, une extension suffisante de l'effet de ventilation.

5 À titre d'exemple non-limitatif, les dimensions peuvent être les suivantes :

- le diamètre des tuyaux d'admission (2) et d'évacuation (6) de 5 mm ;

- le diamètre du fil d'acier du ressort hélicoidal (5) d'un mm ;

10 Toutes les autres dimensions sont variables en fonction de la grandeur de la chaussure .

## REVENDICATIONS

- 1.- Dispositif pour écarter entièrement, par ventilation, l'effet ennuyeux de la transpiration des pieds dans des chaussures fermées, caractérisé en ce qu'il comporte un filtre (1), continué par un tuyau vertical d'admission (2), pourvu d'une soupape d'admission (3), laquelle assure, par son fonctionnement la pénétration de l'air de ventilation dans le système et d'où commence le tuyau horizontal d'évacuation (6) muni de la soupape d'évacuation (7) et de quatre orifices d'évacuation, dispositif caractérisé en ce qu'il comporte aussi le soufflet (4), prévu à l'intérieur d'un ressort hélicoidal (5), lequel produit la variation du volume du soufflet et de la pression de l'air qui se trouve à l'intérieur du système.
- 2.- Dispositif selon la revendication 1, caractérisé en ce que le filtre (1) est placé à l'extrémité supérieure du tuyau vertical (2).
- 3.- Dispositif selon les revendications 1 et 2, caractérisé en ce que, la soupape (3) est munie d'une bille (3b) située dans un canal avec conicité (3a).
- 4.- Dispositif selon l'une quelconque des revendications précédentes, caractérisé en ce que le soufflet (4) présente un ressort hélicoidal (5), confectionné d'un fil d'acier qui s'enfouit dans la masse du soufflet quand il est mis en état de tension.
- 5.- Dispositif selon l'une quelconque des revendications précédentes caractérisé en ce que la soupape (7a) est pourvue d'un manchon de caoutchouc qui assure son fonctionnement en relation avec la pression, elle s'ouvrant à une valeur déterminée de la pression à laquelle s'était prévu que l'air puisse s'évacuer.

FIG 3      FIG 1      FIG 4

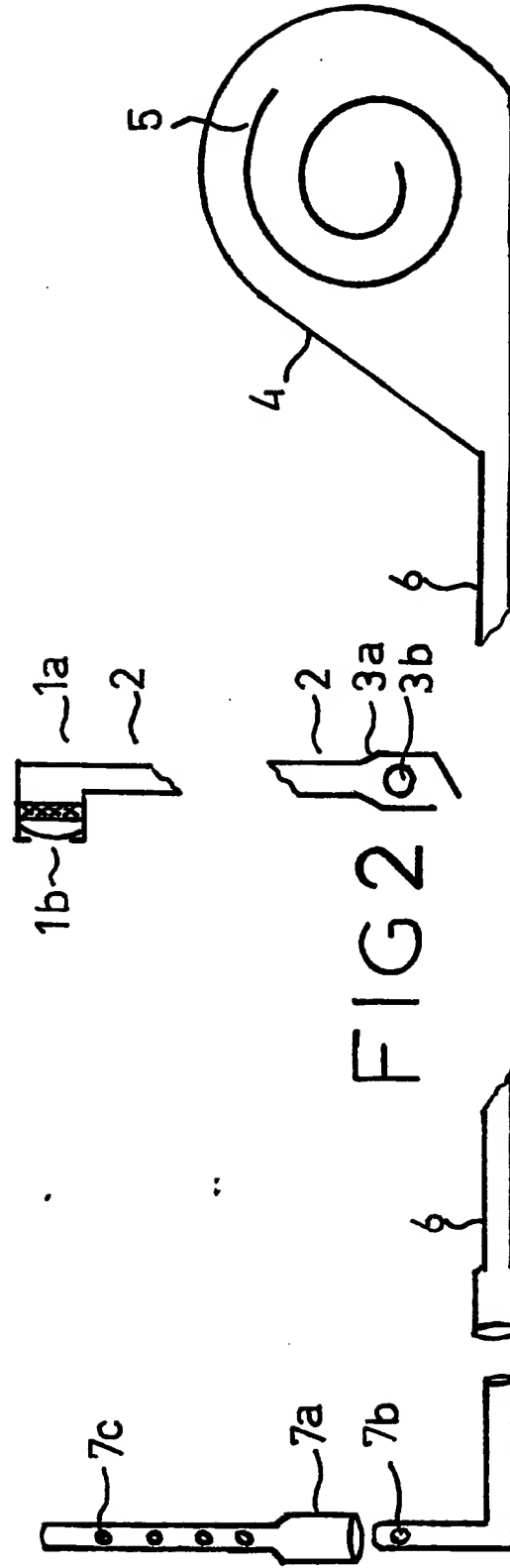


FIG 5

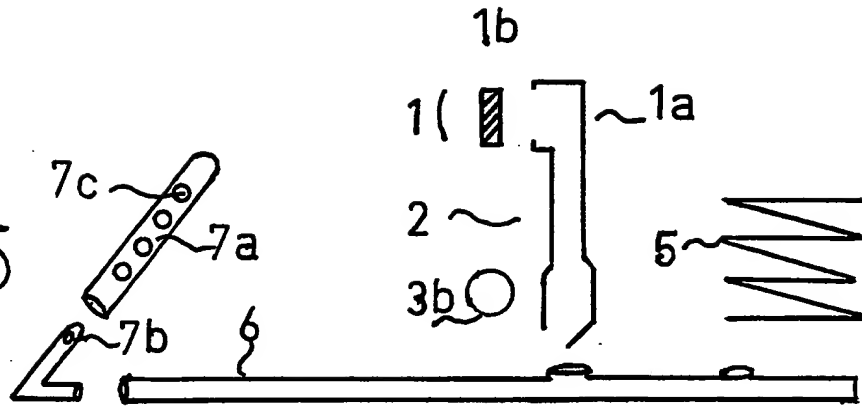


FIG 6

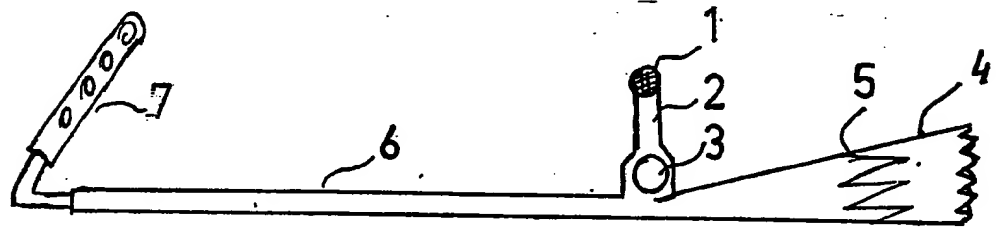


FIG 7

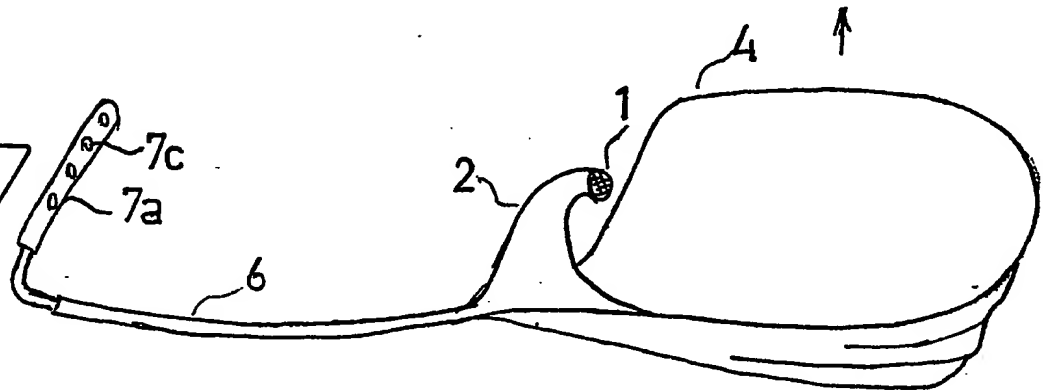


FIG 8

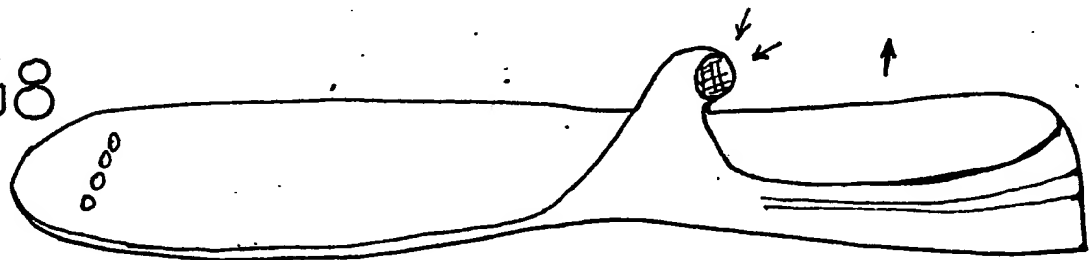
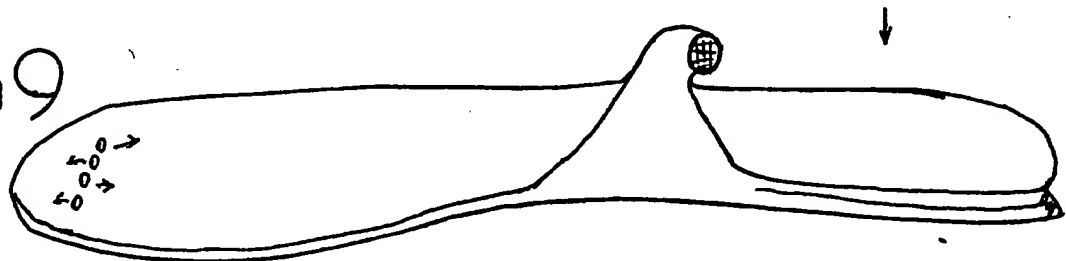


FIG 9



French Patent Application No. 2 670 369 A1

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Job No.: 2397-88789

Ref.: 005127.00094

Translated from French by the Ralph McElroy Translation Company  
910 West Avenue, Austin, Texas 78701 USA

FRENCH REPUBLIC  
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PATENT APPLICATION NO. 2 670 369 A1

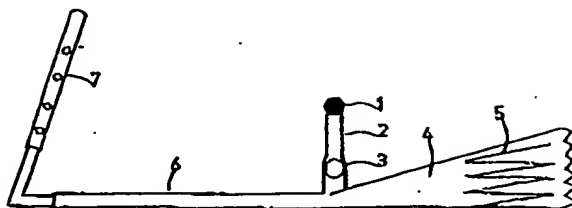
Int. Cl.<sup>5</sup>: A43B 7/06  
Filing No.: 90 15663  
Filing Date: December 14, 1990  
Date of Public Access  
to the Application: June 19, 1992 Bulletin 92/25

DEVICE FOR VENTILATION OF THE FEET BY INTRODUCTION OF FRESH AIR INTO  
CLOSED SHOES

Inventor: Colesnicenco Nicolae  
Applicant: Colesnicenco Nicolae

Abstract:

The invention concerns a device that produces a cycle of alternating successions of intakes and discharges of fresh air using the mechanical force produced by the heel during walking. It is provided with air filter (1), connecting tube (2), intake valve (3), bellows (4) provided with a spring (5), discharge tube (6), discharge valve (7). The bellows (4) is subjected by the heel of the user to the intake of fresh air alternating with its discharge, as a result of valves (3) and (7) which cause the fresh air to advance within the shoe. The device, designed for the shoe industry, is used for removing unpleasant odor produced by sweating.



The present invention concerns a device designed for ventilating the feet in closed shoes. As a result of this invention total removal of the unpleasantness from sweating is successfully achieved.

From the point of view of ventilation possibilities, traditionally shoes are either cut out or provided with lateral ventilation orifices or perforations, these possibilities not being sufficient to eliminate undesirable sweating.

The device according to this invention allows this drawback to be remedied.

This device may be included in the technical field of the leather and shoe industry and at the same time, it may be part of the production of small workshops.

It is possible either for the device to be incorporated in the shoe assembly or to be introduced later into a traditional shoe.

The device according to the invention includes the following principal elements:

- a vertical intake tube provided at the top with a filter
- an intake valve
- a bellows provided with a helical spring
- a horizontal discharge tube provided with a valve which is opened when the air pressure value in the horizontally oriented tube reaches the value established by calculation, this happening by increase

According to the specific methods of the embodiment:

- the intake valve may either be part of the filter or intake tube – the vertical tube – or of the bellows of this device;
- the bellows may either be provided with two lateral springs located on the two sides, the left side and the right side of the bellows, or with a helical spring, located centrally

The attached drawings illustrate the invention according to the following method:

- Figure 1 represents the cross section of the filter of the device according to the invention;

- Figure 2 represents the vertical section of the intake tube and the intake valve of the device according to the invention;
- Figure 3 represents the cross section of the discharge tube with the valve that functions at a constant and predetermined pressure, represented with the discharge orifices for the ventilation air;
- Figure 4 represents the cross section of the bellows with helical spring, inside, placed centrally;
- Figure 5 represents the disassembled device;
- Figure 6 represents the cross section of the device according to the invention;
- Figure 7 represents the device according to the invention viewed from above;
- Figure 8 represents the sole in the state of rest;
- Figure 9 represents the sole tensioned by the heel.

In reference to these drawings, the device includes the air filter (1) located at the beginning of the vertical intake tube (2) that is provided inside with an intake valve (3) located at the bottom, very near the bellows (4), the bellows being provided with a helical spring (5) located centrally.

At the continuation of the bellows (4) is found the horizontal discharge tube (6) provided with a discharge valve (7), this tube finishing with small orifices (7c) for the discharge of air, thus liberated under pressure.

The air filter (1) represented in Figure 1 consists of:

- A rubber sleeve (1a) and a filtering material (1b) such as felt or another filtering material.

The intake tube (2) represented in Figure 2, connects the air filter (1) with the intake valve (3).

It is made of rubber.

The intake valve (3) is attached to the interior of the vertical intake tube (2) and is made from a mixture of rubber and plastic.

The valve (3) contains on the interior a tapering channel (3a) and a polystyrene bead (3b).

The horizontal discharge tube (6) begins from the valve (3), represented in Figure 2, in the intake tube; it is provided on the other end with the discharge valve (7) and represented with the valve and its orifices in Figure 3.

The valve (7) ensures the discharge of ventilation air starting from a pressure value of the air in the horizontal tube (6), established beforehand.

This valve has a rubber sleeve (7a), a sealing orifice (7b) and four discharge orifices (7c).

The horizontal discharge tube (6) ends with these orifices that ensure the distribution of ventilation air provided by the system that carries out the artificial pumping and conducts the air from the heel to the toes.

The bellows (4) represented in Figure 4 is closed and made with a rubberized surface or thin rubber, with a central helical springs made from steel wire attached within. This spring, in a state of tension during operation of the system, is buried in the mass of the bellows.

The operating principle of this device is represented by alternating pumping of the air produced by the movement of the heel of the foot during walking.

At the beginning, the bellows (4) is found in a state of rest and its entire volume is filled with air.

This is the situation that characterizes the state before the introduction of the foot into the shoe provided with this device.

At the moment of introduction of the foot into this shoe, the spring (5) is put in a state of tension and the volume of the bellows (4) is caused to decrease. In this state, the air from the bellows (4) is pushed under pressure.

This closes the intake valve (3) and it takes the direction allowed, from the discharge tube (6) after it meets the discharge valve (7) that opens at the moment when the value of the air pressure of the tube (6), while increasing, arrives at the value obtained by calculation.

When the foot is lifted during walking, the spring (5) is extended as a result of the potential energy accumulated previously in a state of tension, the volume of the bellows begins to increase, and subsequently the creation of a vacuum takes place in which the effect is the intake of fresh and filtered air by opening the intake valve.

The bellows is thus filled with ventilation air and when the heel descends, it exerts a pressure on the latter, by which the decrease in its volume and closing of the intake valve (3) is determined.

The ventilation air is obligated to follow the direction of the discharge tube (6) and it arrives at the valve (7), small gap indicating possible omission this condition being realized with the necessity of overcoming the opposing resistance by the rubber sleeve (7a), resistance wherein the value is chosen relative to the value of the predetermined air pressure.

These calculations are determined in a certain way so that the discharge valve (7) can eliminate the ventilation air at a pressure with a higher value, having the goal of provoking a forced elimination of the clean and fresh air, which pushes the contaminated air to the outside.

The four ventilation orifices (7c) are placed between both toes of the foot to ensure an area of diffusion, a sufficient extension of the ventilation effect.

By way of nonlimiting example, the dimensions may be the following:

- diameter of the intake tube (2) and discharge tube (6) of 5 mm;

- diameter of the steel wire of the helical spring (5) of 1 mm;  
All other dimensions are variable according to the size of the shoe.

FIG 3      FIG 1      FIG 4

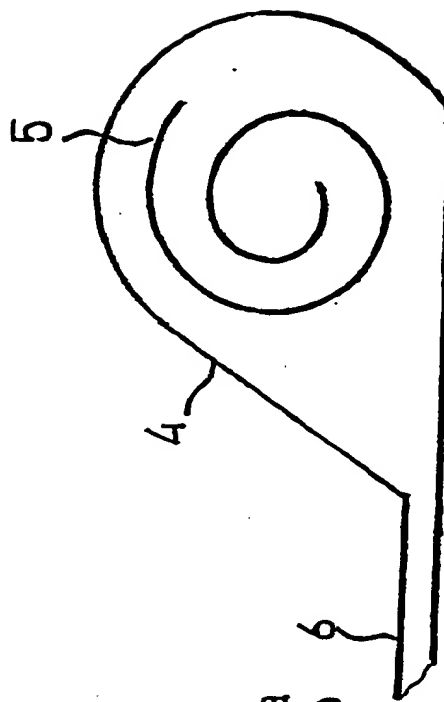
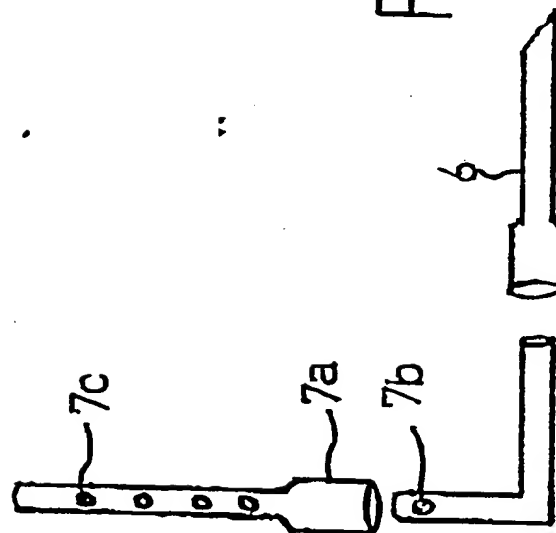
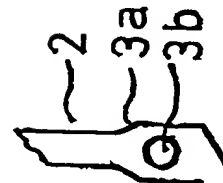


FIG 5

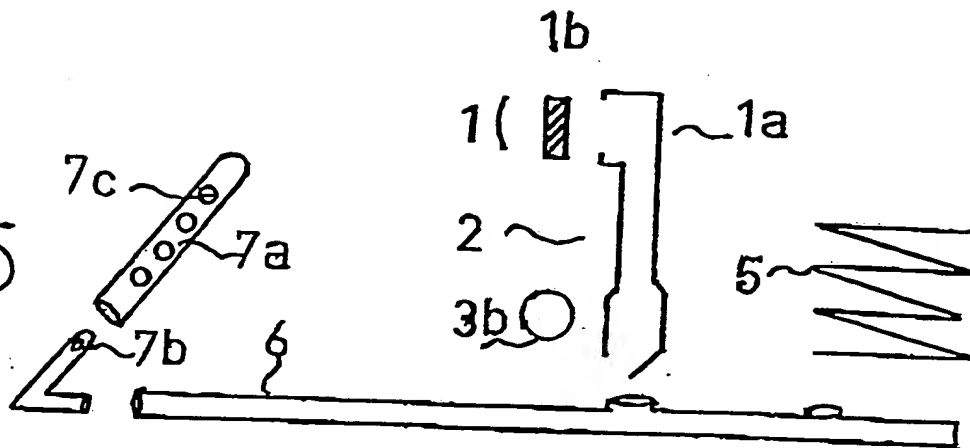


FIG 6

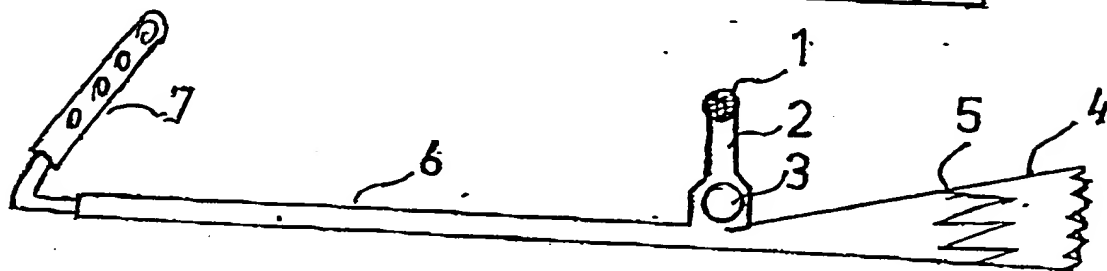


FIG 7

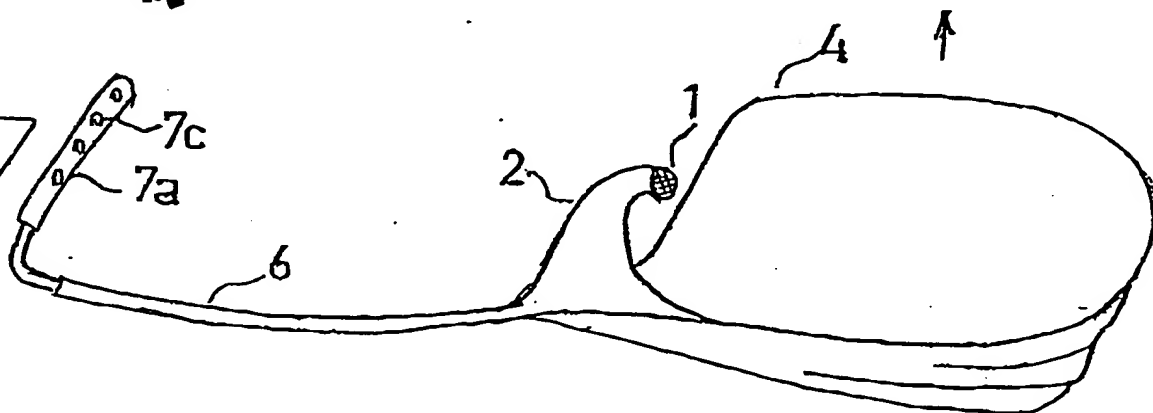


FIG 8

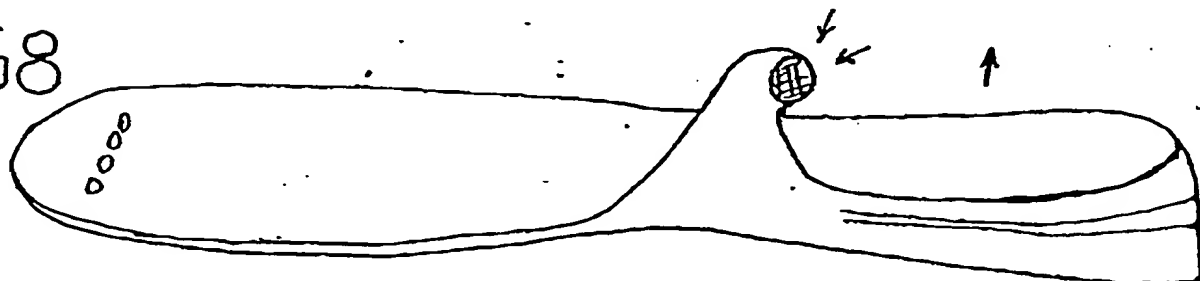
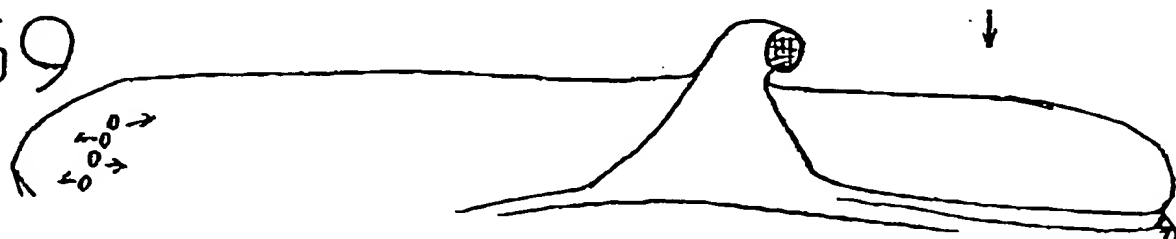
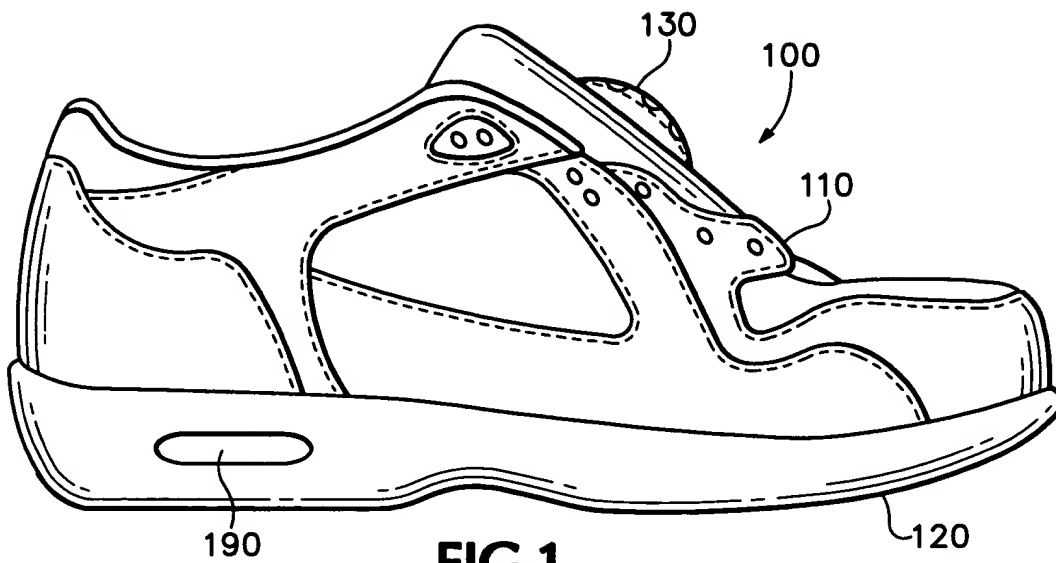


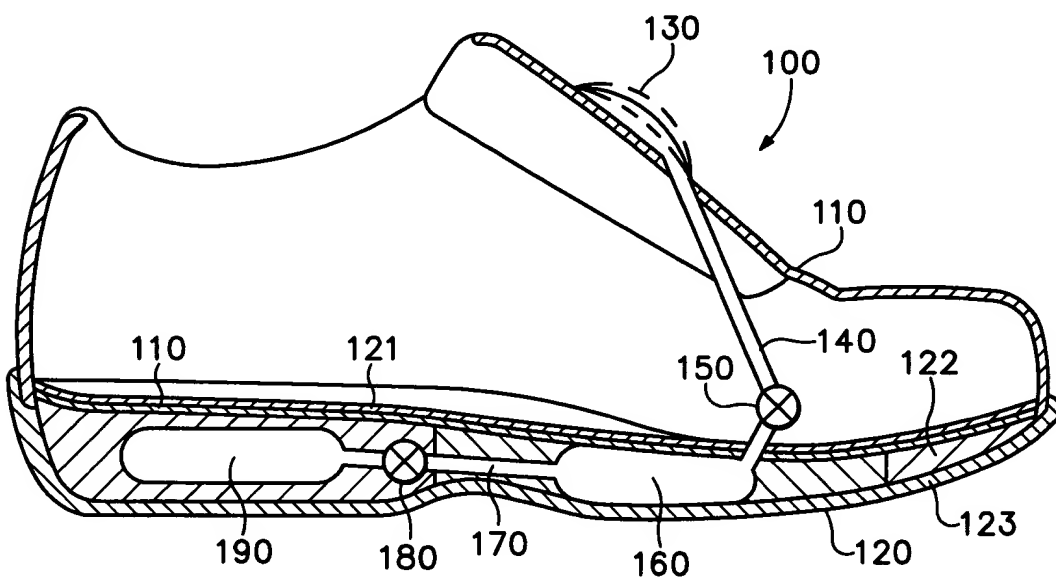
FIG 9



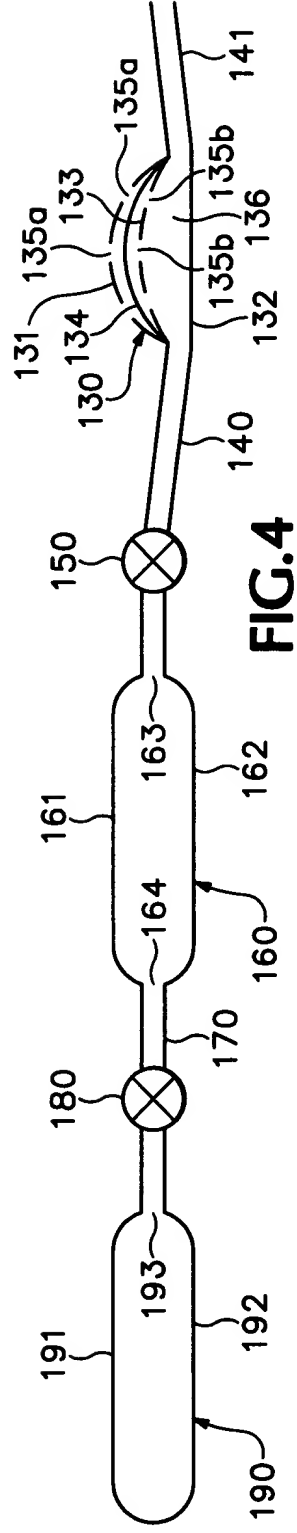
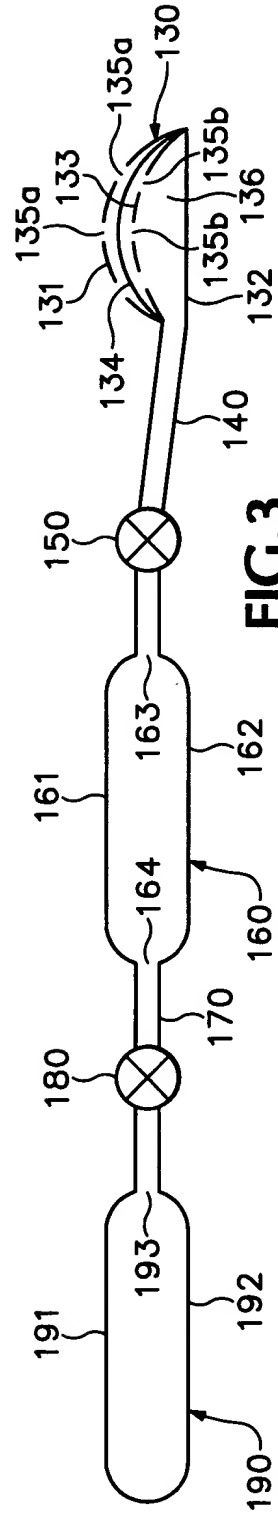
**Appendix E**  
**Figures From U.S. Patent Application Serial Number 09/887,523**

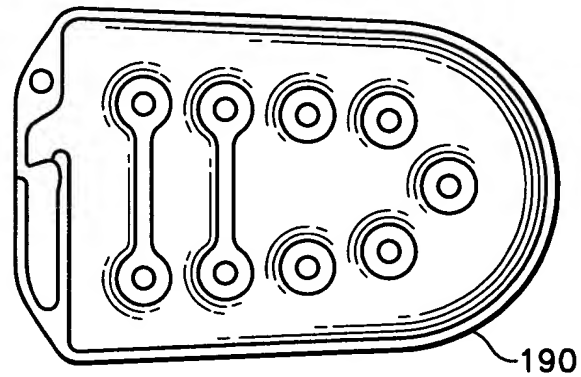
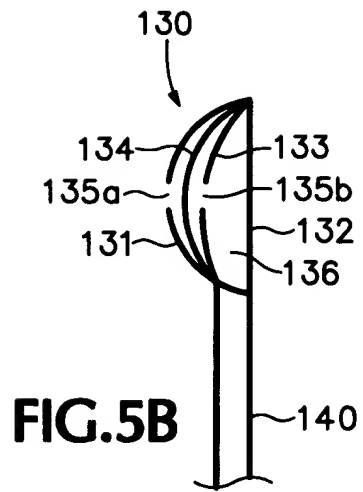
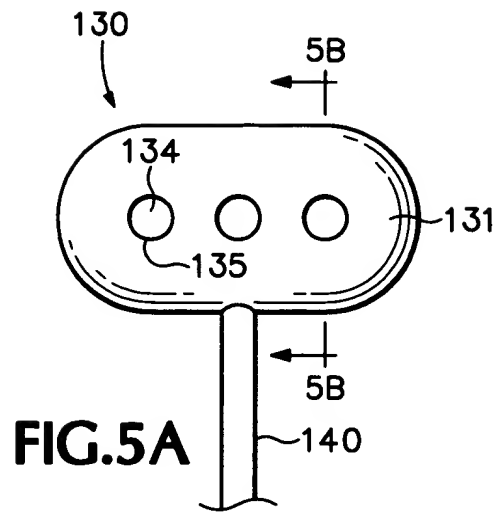


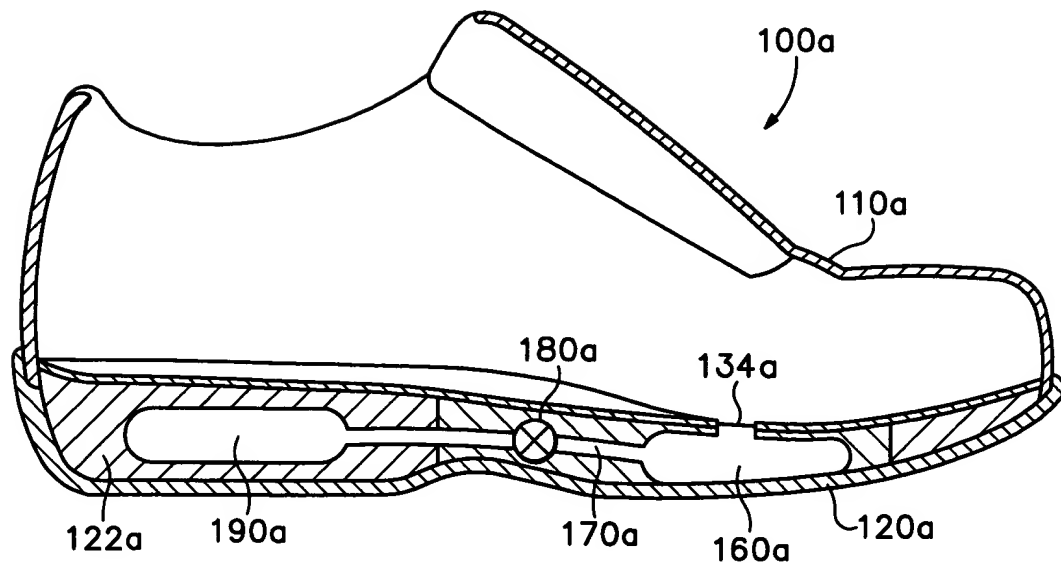
**FIG. 1**



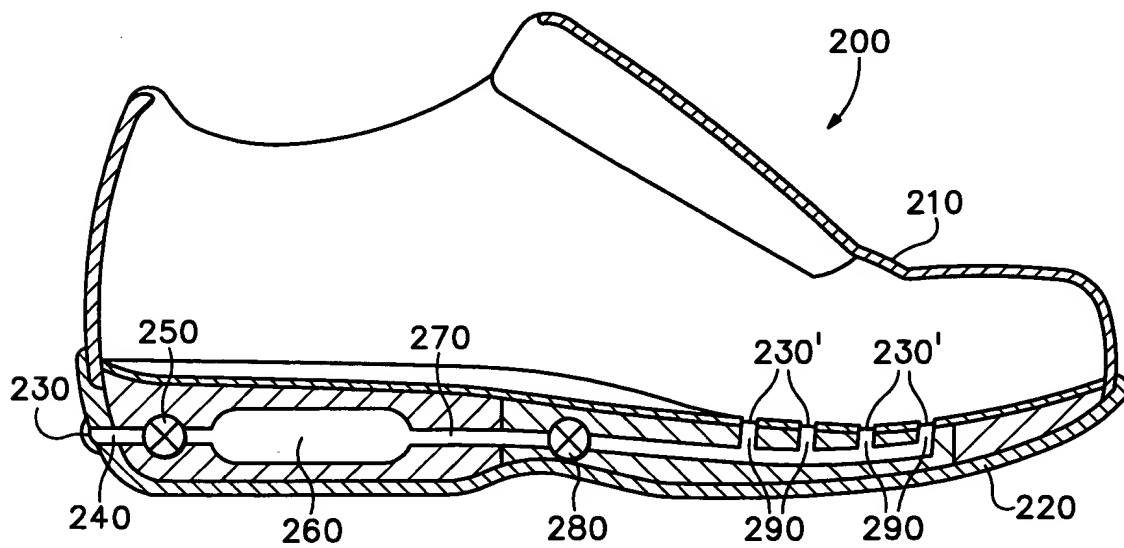
**FIG. 2**







**FIG. 6**



**FIG. 7**